POPULAR AVIATION

Combat Methods Used by Leading Aces (page 348)

WHAT THE MANUFACTURERS ARE SHOWING FOR 1932

Complete Model Plans for *(page 386)*
Building the Lockheed Orion

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(See blueprint on page 23)

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In This Issue

- *How to Build a Short-Wave Converter*
- *Secrets of Jiu-Jitsu Revealed*
- *A Simple Transformer*

Complete Plans for a Model Power Boat

(See blueprint on last page)

(See page 5)

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May, 1932

VOL. 1 No. 1

LARGE SIZE BLUE PRINTS ON SIX PAGES

ALL ARTICLES COMPLETE IN THIS ISSUE

BUILD THIS MOVIE MACHINE FOR $1.00

A Simple Movie Projector Originally Designed to Sell for $10

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by ADOLF LARSEN

THIS month I was assigned a puzzle of a subject for a story. The editor of *Practical Mechanics* called me into his office and said, "Design a motion picture machine for the next issue that can easily be built at home, one that really works and one that does not cost much more than one dollar to build. In fact, I don't see why you can't rig one up for fifty cents."

Well, while the writer has had a considerable amount of experience in designing motion picture projectors, yet this is the first time that he had faced the problem of restoring one for a dollar—so simple that anyone could build it.

It was impossible to consider a standard type projector, a machine with gears, cams, complicated intermittent movements, because the cost of this mechanism worked out to within the range of possibility of an inch. It was evident from the first that we must get off the beaten path if I was to succeed with the job.

Then came the remembrance of an exceedingly simple but effective movie projector that was originally designed by a well known projector manufacturer to sell on the market for $10.00 retail, and which, in turn, had been adapted from the old "Bioscope" principle devised in 1895 by Raoul Hoffert.

Then the manufacturer discovered, after spending about $15,000 in special tools and equipment for building this machine, that it would conflict with his other

(Continued on page 20)

Complete Blueprints for Building a Modern Houseboat

(See page 7; also 14-15)

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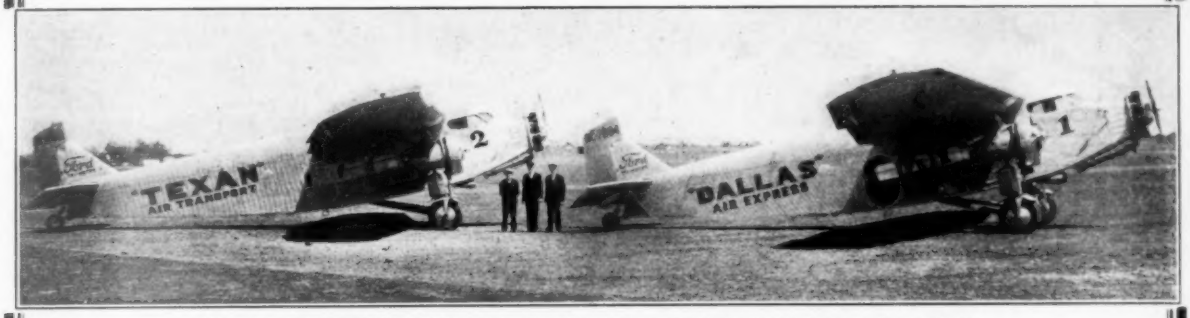

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AERONAUTIC PUBLICATIONS OF THE RONALD PRESS COMPANY

Just Published:

Aeronautics

Fundamentals and Their Application

by Hilton F. Lusk

Professor of Aeronautics, Sacramento Junior College; Transport Pilot; formerly Dean, Boeing School of Aeronautics

FROM this new book you can obtain the information that you need if you are looking for a government license either as an air pilot in any of the grades, or as a mechanic. Even from the condensed and incomplete outlines printed below you can get an idea of the tremendous range of this information.

A remarkably useful feature is the list of questions—224 in all—appearing at the end of each chapter. These questions are typical of those asked in examinations for the Department of Commerce's transport pilot's license with the addition of others to aid you in testing whether you have really grasped the information you have read in the chapter.

If you are interested in getting into aviation but are uncertain which branch you want to enter, you will find just the advice you want in a chapter which lists and describes 125 occupations in the industry, with educational preparation recommended for each, rates of pay, and similar helpful data.

There are 175 illustrations. Nearly every one of these has the component parts of aircraft and instruments lettered in such complete detail that from the illustrations alone you could get an exceptionally broad aeronautic knowledge.

Mr. Lusk writes from a background of practical experience. He holds licenses not only as a Transport Pilot (No. 4405), but also as a teacher at government-inspected flying schools (No. 163).

Although designed primarily for use in ground schools, as well as in colleges and technical schools giving general aeronautic courses, the new book also ideally meets the needs of men who must acquire their knowledge of aviation by home study. Its explanations are so complete and thorough and are written in such easily understandable language that anyone can readily grasp them.

Information to Help You Get Your License

(Condensed Outline of Contents)

PRINCIPLES OF FLIGHT; AIRPLANES AND AUTOGIROS: Theory of flight. Modern theories of lift. Center-of-pressure movement of airfoils. Aircraft drag. Airfoil characteristics. Principles of autogiro flight. Airplane balance, stability, and control.

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AVIGATION INSTRUMENTS AND EQUIPMENT: Description and operation of avigation instruments. Compass and compass compensating systems. Swinging the compass. Use of card and induction compass in flying. Airspeed indicators, use in avigation. Altimeters. Drift indicators. Ground speed indicators. Rate-of-climb indicators.

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Induced Lift: Lost in Stall; Recovered with Slot
Autogiro Airfoil
Tip Vortices
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Power Required for Airplane and Autogiro
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Parts of a Biplane Lower Wing
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Wood Rib Construction: Full Plywood Rib; Lightened Plywood Rib with Stiffeners; Reinforced Plywood Truss Rib; Full Pratt Truss Rib; Full Howe Truss Rib; Full Warren Truss Rib
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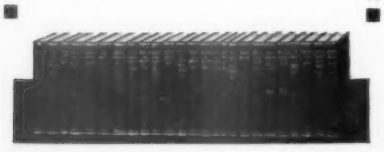

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An Airy Chat With the Editor

OUR inventors are sure putting their brains to work, just as predicted in this column some time ago. Some forty-eleven inventors have called at this office to display their brain children and forty-eleven others have shipped their ideas in by mail, airmail, express—and freight. Fine—fine, let 'em come and more power to them.

And some of these inventions, say about five per cent, have very interesting and promising points that show good clean thinking with a knowledge of aerodynamic principles. But, with even this low percentage of possible runners-up, aviation will be the gainer by the enforced idleness brought about by the depression.

* * *

THIS stress analysis stuff seems to be getting the goats of our lightplane and glider fans—and I don't blame them. The present necessity of becoming a technically trained engineer before one can build a lightplane or glider is oppressive and a serious menace to the science of aeronautics. And the funny thing about it all, is the fact that a stress analysis is no guarantee at all that the parts of the structure are absolutely safe.

During the writer's 25 years' experience in designing engineering structures, he has frequently witnessed the failure of structures that have been accurately computed for stress according to standard and accepted methods. This may sound like heresy but it is the truth, nevertheless. Engineering analyses are very frequently "all wet".

* * *

AND now we have before us the letter written by Samuel Bevins, Holyoke, Mass. Mr. Bevins goes on to remark that he longs to see a clearing up of the present oppressive legislation that is leveled upon aeronautics. This is his report.

"Many years ago, we had technical liberty—but where is it today? In this alleged land of freedom we were permitted to make drawings, build the machine and work it without being compelled to listen to the assinine criticisms of a lot of governmental investigators. And those days, mark you, were the days in which real progress was made.

"Under this system, a man with thirty years of engineering experience is compelled to listen to the drivel of a book-fed recent graduate, because the graduate is fortified by the Government and a nice new shiny badge of authority. If such restrictions are for the best of industry and aeronautics, then make them constructive instead of destructive. What we want with our beer is more liberty."

Yes! Liberty in aeronautics is getting to be a scarce animal. It was necessary during the war to restrict and control certain activities, but most of these birds have forgotten that the war is over.

* * *

WE HAVE a war story in this issue that is considerably different from any war story printed so far. It tells, in considerable detail, of the methods of fighting pursued by the various pilots. It will be well worth your while to read this story which is both entertaining and informative.

Send for Petition Blanks

For the benefit of our readers who wish to solicit more signatures to our petition, we have printed blank forms which can be had for the asking—free. It is no longer necessary to mutilate your magazine.

Send for the new petition blanks today. Don't put this important matter off until tomorrow. So far, we've had a wonderful response from our workers, but we are still below our final objective.

5,128 *SIGNATURES HAVE BEEN RECEIVED TO DATE.*

* * *

WE HAD a visitor at our office the other day, a well known local glider test pilot—"Speed" Westphal. Westphal explained that the picture of the blindfolded glider pilot, printed in a recent issue, was not an ex-army pilot as set forth, but was "Speed" himself. Our apologies in this matter.

* * *

AND this brings to our mind, a very lengthy letter from "A Friend" that was received the other day. The writer of the letter disagreed with the criticisms made in a recent Airy Chat, concerning the importance or non-importance of the large industrial laboratories and the academic persons bearing the title of "Dr." He believes that all inventions and discoveries of importance are made by be-lettered scientists. We still stand our ground and refuse to believe it. Mr. "X" does not believe that the amateur nor free-lance inventor has contributed much to science.

As a proof of my stand, I will quote such well known personages as the Wright Brothers, Glenn Curtiss, Louis Bleriot, Montgolfier Brothers, A. V. Roe, Hiram Maxim and other early pioneers, whom I am certain, did not possess a doctor's degree at the time of their greatest activity. This list should also include Thomas Edison, Michael Faraday, Samuel Morse, Cyrus McCormick, John Stephenson, James Watt, etc.

On the other hand we have a number of men bearing doctor's degrees that failed to register with success, notably Dr. Langley, Dr. Bolsheviat, Dr. Rudolph Diesel, Dr. Twining, Dr. Montgomery and others.

* * *

WE HAVE an interesting and informative letter from William B. Harty, Findlen, Mass., that will throw light upon one more act of our legislators affecting aviation. The letter states that a bill now in the hands of Hon. R. B. Wigglesworth, Congressman of the 14th Massachusetts district, calls for the complete control of all aircraft activities.

According to a copy of the bill, it provides for a Secretary of Aeronautics in the President's cabinet to be assisted by three under-secretaries who shall be in charge of military, experimental, commercial and civilian aviation.

It provides for eight district engineers in Boston, New York, Baltimore, New Orleans, San Francisco, Detroit, Seattle and Chicago. These men will have the power to issue, refuse, suspend or revoke licenses to pilots, owners and parachute jumpers. Also power to order an arrest and to act as a board of inquiry for all aircraft accidents. They examine all applications for A. T. C. and issue same and inspect aircraft at least twice each year.

If this system goes into effect, the present air-forces of the Army, Navy and Marines will be merged into one,

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XUM

POPULAR AVIATION

A Magazine for the Promotion of Amateur Aviation and Private Flying

Volume X JUNE, 1932 Number 6

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Combat Methods Used

Shot down on German soil by a squadron of English combat planes. This photograph was taken by a member of the German Air Corps.

by CARL B. OGILVIE

Noted authority on
World War Aerial Tactics

(Next month POPULAR AVIATION *will publish a similar article by Mr. Ogilvie on combat methods of leading German aces. —Ed.)*

THOUSANDS of men soared into a man-made hell to perform their appointed tasks—to kill or be killed. Six hundred and seventy-five war birds, of all nations, won the coveted honorary title of "Ace."

Yet no two aces fought exactly alike. There were different ways to fight—to kill. Let the other fellow do the dying. Wartime aviation was no joy-hop. It was bitter fighting to the final crash. War birds were forced to fight—to win. Death was an ever-present referee. It was victory or crumpled wings, down out of control, or the most dreaded of all deaths—down in a blistering, flaming caldron of fabric and struts.

Every pilot became a specialist at one particular type of aerial warfare. Some were one-man fighters—lone eagles. Others stuck to formation flying. Others like Rickenbacker, Fonck, Bishop and Richthofen preferred to fly high and deliver the death blow in one terrific dive upon an adversary. Other aces preferred the more dangerous low or middle altitudes.

A good attack pilot rarely made a good observer pilot or a pilot of a bombing machine, yet both observers and bombers did good work at defending themselves and even won victories, but few became aces. Their duty was not to fight. Some of the fighting aces reached the rank of "ace-of-aces"—super-fighters. They killed an unbelievably large number of enemy aviators.

I'm not trying to take any glory away from our fighting pilots when I say that time and circumstance decided many an aerial victory. Call it chance, luck, or fate, as you will. But in every battle there is always the element of luck—good or bad. Captain Roy Brown was in no way as great a pilot as Baron Manfred von Richthofen, yet he was the man chosen by the unseen gods of the air to end the astonishing career of the great German man-killer.

Much has been said about the advantages of a grueling course in acrobatics. Others have claimed that a fundamental knowledge of attack and withdrawals was sufficient, stressing upon the pilot's flying and fighting instinct to carry him through successfully. Contenders of the latter thought pointed out with conviction that there was no such a thing as acrobatics in aerial warfare until Captain Ball of the R. F. C. began cutting capers. They proved that aviators were individuals—that each fought differently.

That is true. Each pilot had his own peculiar individual method of fighting and handling his ship. Aerial acrobatics at Kelly Field, Issoudun, Hedon, Pau or any wartime training field, were like A. B. C.'s in a kindergarten. Rudimentary—they became a part of one. As in reading, we learn to recognize words—not individual letters.

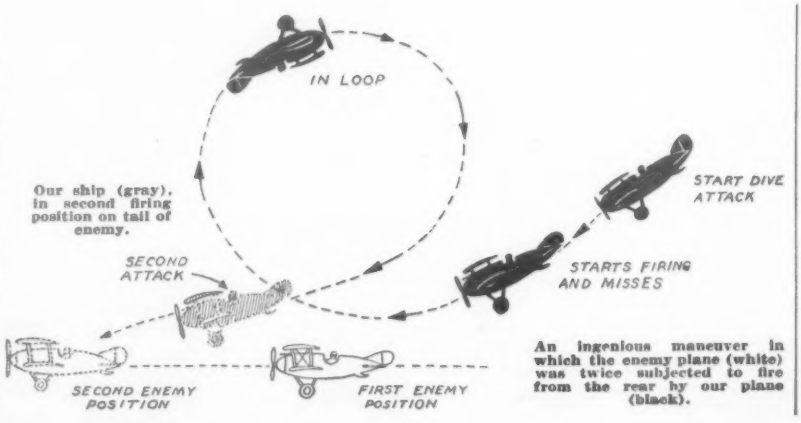
In the air, a pilot in a raging dogfight didn't have time to think out each individual manipulation of his plane. If he was in a tight jam he rode stick and rudder for all he was worth to keep beneath his scalp. When on the tail of an enemy plane, set for the final burst, he rode just as hard until he shot him down.

ONE of the greatest enigmas of the war was the mental attitude towards death displayed by the pilots. Probably it was supreme self-confidence, a mental twist of reasoning or a philosophical disregard for fate. Few, if any of the aces ever, for a moment, believed they would go down to destruction. Others had died, more would die. They? Never!

What if the average life of a pursuit pilot in the zone of advance was estimated to be 68 days and in a dogfight but 7 minutes? They rolled their dice with Death, confident they would never roll a natural. Yet most of them did.

I have always found the flying technique and fighting methods of the aces a fascinating study. A revelation of individuality. All fighting with machine guns and planes. Yet no two fighting exactly alike. Each accredited his victories to some peculiarly individual tactic.

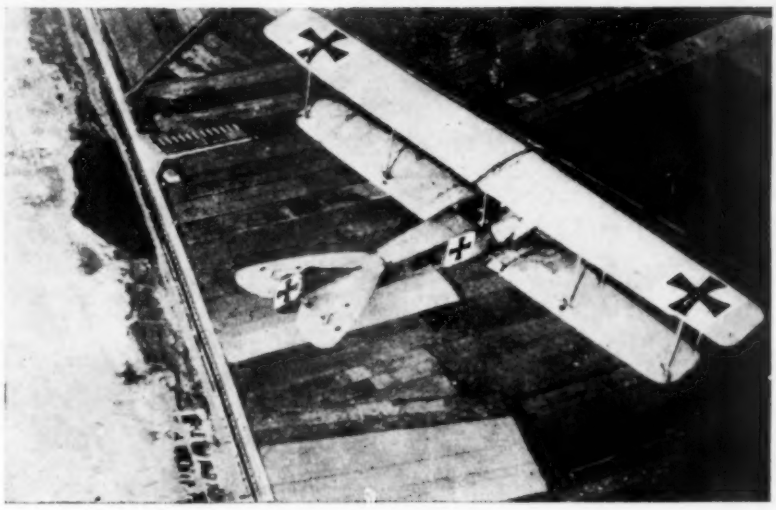
One of the greatest tacticians of the Royal Flying Corps was also its youngest colonel. At the close of the war


IN LOOP
Our ship (gray), in second firing position on tail of enemy.
SECOND ATTACK
START DIVE ATTACK
STARTS FIRING AND MISSES
SECOND ENEMY POSITION
FIRST ENEMY POSITION

An ingenious maneuver in which the enemy plane (white) was twice subjected to fire from the rear by our plane (black).

by Leading Aces

Strategy and tactical maneuvers spelled victory or defeat. In this article, Mr. Ogilvie describes the sensational and clever fighting methods of the greatest Allied Aces.



Attacking a German two-seater from the rear, a dangerous attack because the Allied machine was directly in the firing zone of the rear gun of the German ship.

he was England's first ranking living ace. He was a squadron leader, a great pilot and an astonishing fighter —William A. Bishop.

He learned early the German stunt of escaping from death. Up in a zoom, over on the back, then falling off in a spiralling nose dive. It gave the appearance the pilot was going down out of control. A clever, deceptive maneuver that caught more than one fledgling off his guard.

But Bishop was only fooled once by this clever ruse. He held his fire and followed the gyrating planes earthward. He wanted to make sure. He kept within 50 yards of a tricky falling enemy. If a German came out of his dizzy dive—well, it was just too bad. Many a German pilot got the surprise of his life to find the Canadian pilot still after him.

Bishop favored the high altitudes. With the advantage of height he dove to the kill with the speed of a shooting meteor. He calculated carefully his angled descent, estimated the speed and the direction of his opponent. With everything in his favor, he hurtled straight for the German. But Bishop never permitted himself to fire until he was within very close range. To begin firing at 300 yards, as many pilots did, he regarded as a display of nervous anxiety in the face of the enemy.

BUT once in close, Bishop was at his best. He could redress his ship with amazing swiftness and deadly accuracy. A skilled pilot and a marvelous tactician, he depended upon his unerring marksmanship. He shot his way to victory. He did more. He fought his way into swarming hornet flights of German planes. In a dogfight he exercised every ounce of science he could muster. He miraculously evaded the hornets' sting and came out victorious.

STRANGE to say, the one outstanding factor which contributed largely to Bishop's brilliant fighting career was not his tactics, flying skill nor marksmanship. This young Canadian was a "hater".

He fought with a savage elation—as if ruled by some diabolical mania. A Maltese Cross on the fuselage of a plane flashing by was like waving a red rag in front of a bull. Bishop's bitterness and intense hatred forced him to fling himself on the enemy with staggering, overwhelming ferocity. He sent short, deadly bursts of Vicker's fire into them.

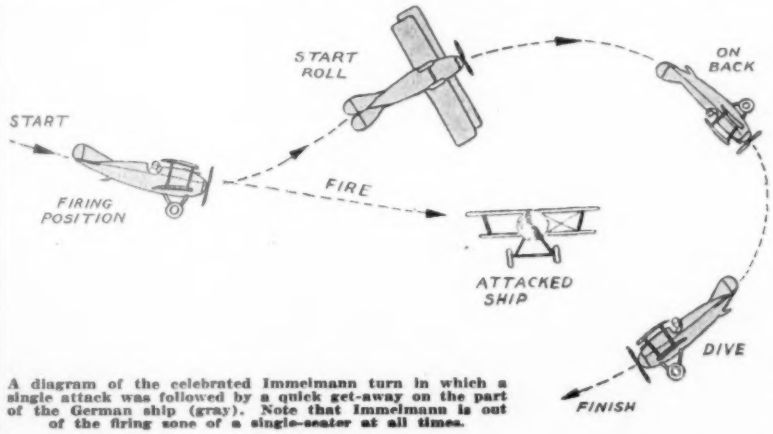
He maneuvered in such a manner that the dismayed Germans were unable to get into position to give him a fatal burst of Spandau lead. Yet, at the same time, Bishop succeeded in getting his man and another victory. Bishop was never once wounded. He rang the bell in the German aerial target for 72 officials.

America's second ranking living ace was just the exact opposite of Bishop. He had the daring and skill, and if he had been in service as long as Bishop, unquestionably would have equalled him in victories. I'm referring to George A. Vaughn, Jr., who won 13 official victories.

Vaughn had the rare ability to become a master of three distinctly different types of combat flying—formation tactics, lone-eagle fighting and bombing. His credo in the air was: "Never permit yourself to be taken by surprise. See the enemy first. Act accordingly."

This slender smiling young man was decidedly a low altitude pilot. This was brought about by the excellent low-altitude maneuverability of the British plane he flew at the front. I've watched him take off and zoom up almost like an autogiro for nearly 1,500 feet. I've watched him worry German Albatrosses and Fokkers down to the tree tops—then give them a final deadly burst.

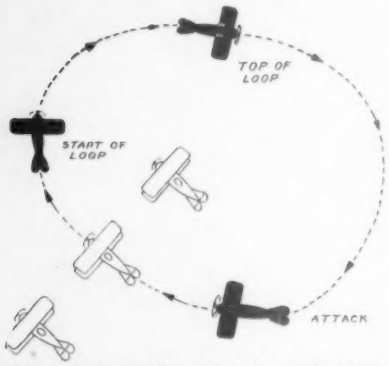
On bombing missions he usually flew at 900 feet. And he seldom went hunting at much over 7,000. This gave the Germans a sheer drop of two miles on his ship. But this ace, who could do anything asked of a pilot in the air, knew how to take care of himself. He was never once wounded. By being on the alert, seeing the enemy before they spotted him, he maneuvered as



A diagram of the celebrated Immelmann turn in which a single attack was followed by a quick get-away on the part of the German ship (gray). Note that Immelmann is out of the firing zone of a single-seater at all times.

circumstances required and won one victory after another.

MAJOR EDWARD MANNOCK, whose total number of victories exceeded Bishop's by one, was known as the "Fighting Irishman". He was all of that and more. He was a thunderbolt of fury. He could fly any type of fighting plane and seemingly in al-



Three planes (white) attack the single seater (black) from the rear. The latter turns over his pursuers by a loop, and then becomes the attacking plane.

most any condition. He fought in the "Flying Piano" Vicker's job before machine guns were thought of. He attained a brilliant record in "Flaming Coffins", S. E. 5's and the humpy Camels.

Another outstanding British pilot, whom the Germans were unable to shoot out of the battle skies, was Captain James McCudden. Like Bishop he bagged five enemy planes in one day.

This Englishman was a mere youth —a ninety-day pilot. His two outstanding qualities were absolute fearlessness and uncanny flying instinct. McCudden made himself a part of his ship. He flew with a dash and verve lacking in others. But he got where he wanted to go and killed enemy pilots with amazing ease and speed.

With a sweet running motor and aligned twin Vickers, McCudden was unbeatable. So remarkably well did he dress his ship for the attack that he seldom took careful sight through the gun rings. His sense of accurate alignment was so keenly attuned that he merely maneuvered into position and pressed his gun trips. He knew without sighting where his tracers would go.

McCudden's most successful maneuver—like that of many British trained pilots—was a spin. He added a few original variations to his own liking. When a dozen Germans, or so, happened to pounce on his tail, he would go into a spin, a steep dive, a falling leaf and then another spin. By the time that a nose-heavy Albatross had caught up, the enemy pilots were regarding the earth with fish-eyed horror.

The Albatrosses couldn't keep up with Camels and S. E. 5's in a power dive, and many failed to come out of the dive and crashed. No wonder McCudden could thumb his nose at Kaiser Bill's pilots. His 58 victories proved him a super-ace.

A PILOT who lacked flash, and depended upon strategy, was Lieutenant Georges Madon, France's fourth outstanding ace. He was topped only by Fonck, Guynemer and Nungesser. Madon flew everything from 60 h.p. "bird cake" Bleriots to 300 h.p. Spads. And man how he could fly! He won the Croix de Guerre eleven times!

When a sergeant-pilot, he became a "weaving" aviator. He developed the tactic of weaving in and out and around his opponent. His plane wiggled, turned and squirmed like a snake. He kept his machine guns spitting, barking, chewing at enemy aircraft constantly. He darted in and out like a frantic swallow with the tenacity to attack a hawk.

It was impossible for German aviators to ever get him in their sights. By the time they redressed their Aviatiks, L. V. G's, Albatrosses or Fokkers, Madon was somewhere else—usually glued to their blind spot under the fuselage. One stream of bullets was sufficient.

There could be no such thing as "Happy Landings" for the Germans with Madon in the air. If Madon failed to get a victory he went berserk. He threw caution to the wind. He ploughed in with full open engine.

Once this happened when Madon attacked a two-seater L. V. G. Madon dived, firing as he went, for a weaving

Signal Corps Photo.

Out of luck. This German flying officer is taken prisoner just after being shot down.

erratic coursed attack. He saw the man at the Spandaus in the rear cockpit slump and hang half over the rim of his turret.

Now the pilot was at the Frenchman's mercy.

But the German aviator must have been either a very revengeful or foolish man. He rushed at the weaving French plane. He soon discovered that it was impossible to place his tracers anywhere near this thrusting darting pilot. With a heart as stout as that of a lion, he whirled his big ship around

(*Continued on page* 402)

When Gravity Turns Topsy-Turvy

A collection of hailstones several times larger than a hen's egg. The egg (left) is held beside the hailstone for comparison.

WHEN could an aviator jump from an airplane without his traditional safety parachute and be carried upward to an ultimate altitude of approximately 10,000 feet instead of plunging to swift extinction on the rockribbed terrain below?

When do such remarkable atmospheric conditions exist that a heavier-than-air craft with a stalled engine will climb toward skyland's ceiling instead of hurtling to destruction, despite the handicap of its crippled power plant?

The average person, unless he be extremely weatherwise, will be stumped by these questions. And, many of those wise in weather lore will fail to answer the teasers correctly unless they are familiar with the strange atmospheric phenomenon that compells the law of gravity to function in reverse gear so that things which should logically fall now rise instead.

It is during a violent hail storm that nature stages this normal weather condition antithesis. Hail is inevitably associated with thunderstorms which occur in the spring and early summer. Marked contrasts in temperature generate brisk uprushing air currents by vertical convection which sometime attain the stupendous speed of 200 miles an hour.

Weather conditions, which approximate a decrease of 1°F. in temperature for each 180 feet of altitude or more, are effective in hatching out storms in which hail as large as billiard balls, baseballs or sometimes as big as small cannon balls, are shot from the heavens with greater rapidity and intensity than modern shell-fire.

One curious feature of a severe hail storm is its brevity, for it usually lasts

(*Continued on page* 394)

The Inside Story of the Airmail Monopoly

by

WALTER W. LIGGETT

Is our entire Air Mail System threatened by subsidies granted to a few favored companies? Mr. Liggett says, "Yes," in this searching article.

HERE, told in its entirety for the first time, is the amazing story of how the government air-mail subsidy—now amounting to $25,000,000 annually—has almost been completely monopolized by one of the most powerful financial groups in the country.

Four great holding companies, all with inter-locking directorates, are drawing down more than 90 per cent of the $18,000,000 annual domestic air-mail subsidy. A fifth concern, controlled by the Mellon family, is getting a trifle better than 99 per cent of the $7,000,000 which Uncle Sam pays as subsidies each year to encourage the carriers of foreign air-mail.

The whole story of this lucrative monopoly is shocking, but it is a story which needs to be told; for it is only by revealing the facts that public opinion can be aroused to correct this disgraceful condition. Also, the publication of these facts may help prevent the contemplated subsidy for two trans-oceanic Zeppelin lines which is now pending in Congress—and which would be hogged by the same financial interests.

On the plea that it would help make America "air minded", Congress, late in April, 1930, passed the McNary-Watres bill which changed the payment to air-mail carriers from a poundage to a mileage-space basis and allowed the Postmaster General wide latitude in making and renewing contracts. Congress knew at the time, that in effect, it was granting generous subsidies, but it justified its action on the patriotic ground that these payments would promote the languishing aviation industry and thus strengthen our national program of military preparedness.

THE confidence which Congress placed in the administrative branch of the government has been basely betrayed. Instead of developing the industry, as a whole, the air-mail subsidy has been almost entirely turned over to five firms, and they have cunningly used this financial advantage as a weapon to crush out independent competition.

One of the first air-mail planes operated on scheduled service. This is a converted warplane, a "DH" to be exact, which has seen long service in carrying mail.

Individual aviators, who daily risked their lives pioneering hazardous routes, are finding themselves forced out of business and a livelihood by a clique of capitalists and politicians who control the four favored companies.

Here are the four interlocked companies—in the order of their importance—which, thanks to official favoritism at Washington, have a virtual monopoly on domestic air-mail subsidies:

I. UNITED AIRCRAFT & TRANSPORT CORPORATION. This concern was incorporated October 30, 1928, in Delaware. It owns the Boeing Airplane & Transportation Corporation, Pacific Air Transport, National Air Transport, Varney Air Lines and Stout Air Lines.

The United Aircraft operates trunk lines from New York to San Francisco, via Chicago. It has one spur line running from Chicago to Dallas, Texas, and another from Salt Lake to Spokane, Portland and Seattle. It also flies planes from Seattle to San Diego.

During the fiscal year of 1930—the last year for which detailed records are available—the companies affiliated with the United Aircraft and Transport Corporation received $7,973,058.30 for air-mail contracts—or 54 per cent of the entire subsidy.

II. NORTH AMERICAN AVIATION, INCORPORATED. This holding company was organized December 6, 1928, with a Delaware charter. It owns the Eastern Air Transport, the New York & Atlantic Seaboard Air Express and is heavily interested in the Transcontinental Air Transport-Maddux Company.

The transportation companies owned by the North American Aviation only have two air-mail contracts, one from New York to Atlanta and the second from Atlanta to Miami, but these paid $1,624,792.90 in 1930 and were worth far more last year.

III. AVIATION CORPORATION was incorporated in Delaware on March 1, 1929, as a holding company. Through the American Airways it owns and operates the Canadian Colonial Airways, Colonial Air Transport, Colonial Western Airways, Continental Air Lines, Inter-State Air Lines, Gulf Coast Airways, Texas Air Transport, Robertson Aircraft Corporation, Southern Transcontinental Airways and is part owner of the Southern Air Express.

The American Airways has almost a monopoly of air transport in New England. It also operates lines in the

This modern monoplane, used today for the transport of mail, is a striking contrast to the old "DH" bi-plane used in former years.

Middle West and South and has one route from Atlanta to Los Angeles. Altogether, it has twelve air-mail routes which paid $1,901,489.42 in 1930 and more than $2,000,000 last year.

IV. TRANSCONTINENTAL AIR TRANSPORT, INC. This company was organized in May, 1928, for the purpose of establishing a combined air and passenger route from New York to Los Angeles. The Pennsylvania Railroad holds a controlling block of stock, but the Keys interests and the Bancamerica crowd also have heavy investments.

The Transcontinental Air Transport, through its subsidiary, the Transcontinental and Western Air, Incorporated, has five air-mail contracts. In 1930 it received $2,461,512.20 in the shape of government subsidies and last year its air-mail contracts nearly touched $4,000,000.

The McNary-Watres bill was full of jokers. It specified that the Postmaster General must call for bids, but directed him to award contracts "to the lowest *responsible* bidder". The word "responsible" has been used to cover a multitude of sins. If some independent underbids one of the "Big Four", the Postmaster General frequently will decide the low bidder is not "responsible" and the high bidder gets the contract.

THE McNary-Watres bill also provided that "the Postmaster General, when in his judgment the public interest will be promoted thereby, may make any extensions or consolidations of routes which are now or may hereafter be established".

Postmaster General Walter Brown has so misused the extension clause of the bill that Representative Clyde Kelly of Pennsylvania, chairman of the sub-committee in charge of legislation of the House Postoffice committee, recently declared that he was "prostituting the nation's air-service with monopolies".

Congressman Kelly declared that Brown had attempted to have written into the bill a provision giving him power to award all air-mail contracts without calling for bids. This feature was eliminated in the committee, but Kelly said, "Although Congress presumably defeated the Postmaster General in this attempt, and included mandatory provisions requiring bids, it is perfectly clear the Postmaster General is administering the bill to an end not intended by Congress".

Postmaster General Brown is an old time practical politican, known as the boss of Toledo before he became one of President Hoover's campaign managers and was rewarded with a place in the Cabinet. Ever since the McNary-Watres bill became a law, he has gone contrary to the plain intent of Congress, ignored the demands of the independents and deliberately tried to build up a gigantic air-mail monopoly.

(*Continued on page* 404)

This Ship is Carried by the Akron

The F9C-2 is the essence of compactness for it is stored inside the hull of the "Akron" when not in flight.

THE F9C-2 was designed to be the smallest airplane which could be built around the Whirlwind 420 h.p. engine with the pilot and the required military equipment. The size of an airplane is necessarily an important consideration in operating from a rigid airship.

Structurally, the outstanding feature of the machine is the metal monocoque fuselage. The skin is formed by dural sheets riveted together and braced internally by dural bulkheads and longitudinal members. The ship is a biplane with wings of the gull type, fairing directly into the fuselage. Spars are of tubular dural construction, ribs are stamped dural and the wings are covered with fabric. The ailerons are on the upper wing only.

Tail surfaces are metal covered and faired into the fuselage. The tail skid is of the full swivel wheel type. The landing gear is of the single strut, split axle type, with spats over the wheels and equipped with brakes. The 420 h.p. Wright Whirlwind engine is enclosed with an anti-drag ring which increases the speed.

The little plane is only 19 feet long, has a wing span of 25 feet 6 inches, has a top speed of approximately 180 m.p.h. and can climb 1,800 feet per minute.

British All-Purpose "Eight-In-One" Plane

THE Westland Aircraft Works, Yeevil, England, has just finished the construction of this new fighting plane for the British Army.

Designed like a racing machine, with high speed (at present a secret), it has an unusual carrying load and can be used for reconnaissance, desert patrol fighting, day bombing, aerial photography, pursuit work and transporting supplies and men. It has a non-stop cruising range of 1,000 miles.

The design of a general utility airplane for military service is a very difficult matter because of the many conflicting factors that arise in the various duties to be performed.

The British All-purpose military plane which is designed to perform a wide range of service.

XUM

Tales Told 'Round the Hangar

By Kelley McLean
Melvin, Texas

"THE toughest place that I have ever been in," said Smithy, pulling one ear thoughtfully, "was last summer when I was flying cross-country down in Texas with a cargo of motion picture films.

"I had been flying something over an hour and had about 1,200 feet altitude, when without any warning whatsoever, there was a sharp whistle and then the motor simply ran away before I could pull back on the throttle. Imagine my surprise to discover that I had no propeller.

"While locating a landing place I turned the cutoff in the gas line and allowed all the gasoline in the line to burn, while I was gliding in for a landing. This burned out before I landed, and I then cut both switches. I thought that, judging from the landing field I was going to have to use, that I might have a crack-up.

"I might avoid a fire, if there was no gasoline in the carburetor. I am inclined to believe that some crash fires are caused by bursted carburetors and bursted gasoline lines letting gasoline come in contact with the hot exhaust stacks.

"The only place that I could locate within gliding distance that would do for a landing was a pasture studded with Mesquite trees. Incidently let me tell you that there is mighty little time to look around for a field while gliding from 1,200 feet, and as while flying, I had not taken notice of wind direction.

"I now had to find that out also, while coming down. This kept me busy, but I picked out the flat part of the pasture with the fewest trees and came down on the thin edge of a stall.

"The landing was perfect except that some large bushes ripped the covering half off of the lower wings. Before I had hardly gotten out of the plane, I was met by a farmer, his three children, and his dog, who had seen me come down and whose pasture I was in. He agreed to take me and the films in to town where I chartered a car and finished delivering the films on time.

"Examination showed that the crankshaft had crystalized and broken right next to the thrust bearing and this had left the propeller with nothing to support it. The propeller was found about half a mile from where I landed, but was badly broken on one end where it hit the ground. A new crankshaft and propeller were installed in the plane and a number of trees cut away so as to make a runway. The plane was flown home and the wing repaired there."

And Smithy was fortunate at that. Crystallized crankshafts caused by wobbly propellers or loose bearings have at times, torn the front end of to pieces—frequently with fatal results. Any unbalanced weight on the prop sets up tremendous bending moments that eventually exact their toll.

Hull and Center-Section of Mammoth Junkers

The huge Junkers under construction. Note the tremendous thickness of the wings and the outboard engine and prop mountings.

THE Junkers factory, near Berlin, Germany, is completing this giant monoplane for service on the air lines between Berlin and London. The plane is expected to be commissioned some time this summer.

Among the features of especial interest in this plane are the wings and their special construction. Built with a truss internal bracing they accommodate not only the engines, but also several passengers. By increasing the passenger space, the pay load is also increased. Most of the engine is also included in the inside of the wing. Illumination and vision is afforded the passengers by means of windows set flush with the outside of the wing.

The nose of the plane contains the smoking compartment, safely isolated from the rest of the plane. The usual accomodations for passengers and their comfort is amply provided for in the interior of the fuselage.

The range of vision that is afforded to the pilot is one of the main points of interest. Notice the windows in the forward corners of the cabin. They remove the blind spot that has caused considerable trouble in the past.

One might very well imagine that another blind spot would be directly in front of the plane. Such is not the case. Between the pilot's cabin and the smoker is a large sheet of glass. The pilot is able to look through this window and see the ground directly before the plane through the windows in the smoking cabin.

The "Helena" Used on Scheduled African Run

THE "Helena", a mammoth airmail liner of the Great Imperial Airways, recently made the initial trip from the Croyden, England, airport to South Africa. The new mail service began on January 20th, and will be a regular feature of the transportation company.

It is expected that mail delivery will be cut to one-fourth the present time. This is a notable stride forward.

The large British transport ship, the "Helena". Note the excellent range of vision attained by the long projecting nose of the plane.

Tropical Air Transportation

MAIL lifted over the Andes and merchandise "air-trucked" above the Mexican highlands, have brought transport speed to the tropics, as revealed in Pan American commercial reports.

A Falcon plane and a Bellanca airbus, each reinforced by a G. E. supercharger, have brought about these conditions. The plane takes mail daily and passes from 100° F. to —40° F. and back again.

This makes it imperative to supply the pilot with extra oxygen and to give aid to the engine by means of the supercharger. The airbus, on each flight, carries 2,700 pounds of silver ingots from the Tayoltita airport, near Mazatlan, Mexico, 240 miles to the railhead at Torreon.

Mountain-climbing burros, which followed miles of laborious and circuitous route, gave way to the new method. A saving in time of whole days is made possible.

Saved by a Split Second

A FLYING instructor and a Government test pilot at a California airport were testing an experimental monoplane for the purpose of licensing the plane.

At an altitude of 5,000 feet he tried to stall and spin the plane, but it failed to respond until he had dropped to 3,000 feet. Then he tried to bring it out of the spin and it got out of control. With a roar the plane dived down with the pilot struggling at the controls.

He tried to right the ship by shifting his weight, but at 1,200 feet he stood up in the cockpit. A split second later he was hurtling earthward. Pulling the release on his parachute it popped open and the next second the pilotless plane flashed by nearly hitting him.

The plane struck near the airport with terrific force and only parts of it can be salvaged. The pilot escaped unharmed.

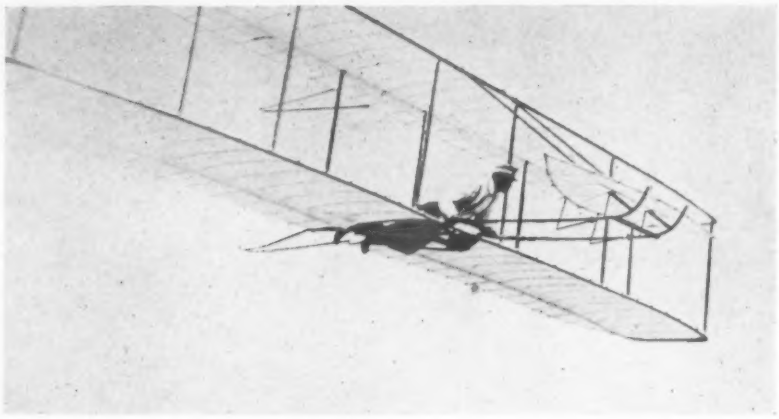
Non-Stop Fighting

DURING the World War, airplanes were supplied with gasoline for two-hour flights. When this gas gave out, the pilot hi-tailed it to home and fireside.

Today, the United States Air Corps has planes equipped with auxiliary tanks capable of carrying ships 400 miles at a speed of 200 m.p.h. Reaching the scene of a harassed zone, the pilots can drop their auxiliary tanks, lighten their load and have plenty of juice to go immediately into battle without landing to refuel.

What might have been the accomplishments of Rickenbacker, Luke and the rest of our air heroes, had they been equipped with modern-day pursuit planes?

Thirtieth Anniversary of Gliding Flight (1902-1932)

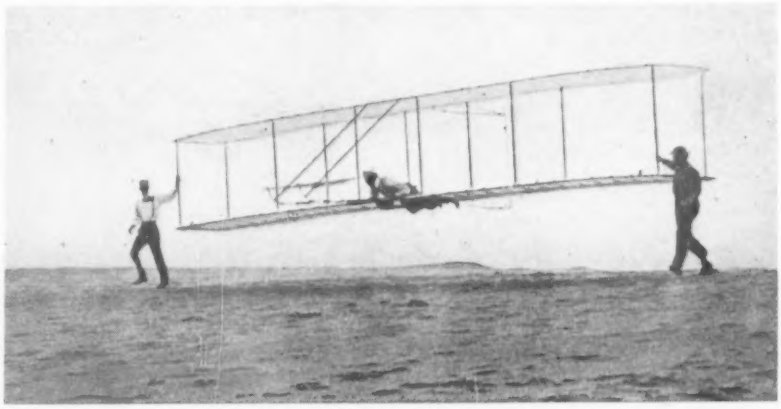


A close-up view of an early Wright Glider soaring over the sand dunes of Kittyhawk.

THIS year, 1932, is the thirtieth anniversary of the gliding and soaring flights performed by the Wright brothers in 1902. This discounts the idea that all experiments in gliding and soaring originated in Germany.

The accompanying illustrations are excellent close-up views of the Wright brothers' biplane gliders as they appeared when gliding and soaring over Kill Devil Hill. It might be that the reduction of head resistance by lying prone during a glide will be of value to our present day glider fans. It is possibly a better proposition than streamlining the nacelle used on the modern glider—although possibly not as comfortable.

It will probably be remembered, that a soaring flight, having a duration of approximately ten minutes, was made by the Wright brothers about thirty years ago in biplane gliders of the general type shown here. It was demonstrated during these flights, for the first time, that an inclined upcoming stream of air had the power to sustain a glider in motionless flight for considerable periods of time.



This is just one more method of taking-off, a method successfully used by the Wright Brothers in 1902.

The National Museum of the Air

THE White House, Washington Monument, Tomb of the Unknown Soldier, government buildings, Mt. Vernon—these and a host of other historical spots are the mecca of thousands of visitors to the nation's capital, Washington, D. C., each year, but travers, especially the aviation-minded, who visit that city this year are in for an additional rare treat.

Opened only a short time ago, the National Museum of the Air is already the finest of its kind in the world. Housed in the hangar-like building—really an annex to the famed National Museum—are planes, models, pieces of equipment and other objects considered priceless by the United States government.

The particularly bright star of the collection is, and probably always will be, the trim, silvery "Spirit of St. Louis", in which Col. Charles A. Lindbergh streaked to Paris. Here, too, is the Bremen, huge Junkers airplane

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XUM

Johnny Starr—First Aerial Weatherman

by W. H. GRAHAM

Everyday, Johnny Starr soars aloft, to take weather observations that are of assistance to commercial pilots and the air-minded public at large.

AS surely as the automobile supplanted old Dobbin and as certainly as the incandescent lamp chased the kerosene lamp and gas-burning wick into oblivion, so is the airplane and the flying weatherman making kites and balloons hopelessly old-fashioned in Uncle Sam's daily quest for a true picture of the weather.

Mark Twain once observed in his quaint way that the weather was something of which we constantly talked, "but never did anything about", but Uncle Samuel's flying weathermen have changed all this. The weather has found a champion at last!

At four of the government's principal weather stations today—Chicago, Cleveland, Dallas and Omaha—these flying aces of the weather bureau service are writing new and thrilling chapters in aviation history with their daring flights into the upper reaches of the atmosphere. Through rain and snow, heat and cold, fog and cloud, these flying weathermen are carrying on for the U. S. Weather Bureau with loyalty and pride that matches that of the Northwest Mounties. And all of this so that those few lines of type which appear nightly in the upper left-hand "ear" of your favorite newspaper under the heading, "Tonight's Weather Forecast", will mean just that.

On a dismal morn one day last August when the sky was full of rain and there was a ground fog so thick you could cut out a hunk of it with your pocketknife, on just such a morning as this, when one feels he hasn't a friend on earth, Johnny Starr, Jr., zoomed into the Omaha airport with a brand new bride, a southern accent, a sleek little Sparton J-67, Wright powered biplane and a contract tucked securely under his arm, to begin the weather flights.

Johnny Starr in his flying togs ready to take-off for the upper and colder regions.

An intimate consultation with the airport cat is something to be considered.

Starr looked more like a kid than the seasoned flier he was and old-timers at the field shook their heads and 'lowed that he wouldn't last a week. Starr is just past 23, not much more than five feet six tall, and is boyish looking. His bride is 19, furiously red-headed and is from Oklahoma, too.

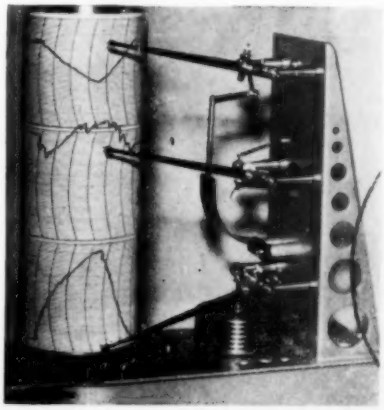
As they stood there getting acquainted and scanning the gloomy skies, I don't suppose Starr ever gave a second thought to the strange adventure that lay ahead, the hard work, the hair-raising experiences and, I am also glad to report, some measure of profit. Business prophets to the contrary, Johnny Starr has found the winter anything but dull!

He's met and shaken hands with thunderheads, fought sleep at 24,130 feet without oxygen, gotten lost too many times to mention and been forced down far from home with his gas tanks empty, but now, looking back over five months of battling the elements, Johnny Starr will tell you it's a great game if you haven't got a weak heart.

His contract calls for a daily flight to a minimum of 1,500 feet, but to induce him to go higher, Uncle Sam offers him a bonus of $2.44 for each additional 1,500 feet. Johnny doesn't begin to hit real "pay" altitude, however, until he gets considerably above 1,500 feet, because his expenses are heavy and his equipment costly. He estimates his investment at around $7,-500. His record flight to 24,130 feet, for example, netted him $41.52. Figuring this on a yearly basis, supposing he could reach 24,000 feet every day of the year, his annual salary would be approximately $15,000. Only on several occasions has Johnny failed to get up at all, once when his motor conked and another time when ice formed on his wings while Omaha was sweltering in a heat wave below.

Far out on the right wing of his ship, Starr carries an "aerometorgraph", a complicated looking doo-dad which looks like a seismograph with three recording pens. Inside of one is strung ten strands of human hair, which contract or expand and measure humidity. On the other graphs are registered temperature and pressure at high altitudes, so important to airmen.

RIGHT from the start, Johnny Starr began setting altitude records for his brother flying weathermen to shoot at. For example, there was that day last September when he soared to 24,-130 feet without the aid of oxygen, a mark that surpassed by nearly four thousand feet the record of his nearest



One of the weather recording instruments carried by Starr in his observation flights.

competitor. The flier at Cleveland has a "best" of 20,746 feet (as this is written); Dallas is a close third with 20,670, and Chicago fourth, with 18,670.

Starr's monthly averages far eclipse the averages of the other three, but he modestly attributes this, not to any superior flying on his part, but to his sturdy ship and super-charged motor. In August his daily average altitude was 20,500 feet; September, 21,417; October, 20,725; and November, 20,760. Later averages are not now available. The fliers at Cleveland, Dallas and Chicago are using lower-powered planes than his, Starr is quick to explain.

His J-67 Wright whirlwind has 240 good, healthy horses hitched to it. Ground r.p.m. are 1,725, and 2,150 in the air. At the higher altitudes, however, the r.p.m. drop off to between 1,700 and 1,800 in a climb. But listen to Johnny, himself, tell about that record flight to 24,130 feet.

"We had heard, unofficially, that the man at Cleveland had gone to 24,000 feet, and my best previous altitude up to that time was something over 20,000. Naturally, I wanted to beat him or bust, and, frankly, I almost busted. Around 24,000 feet everything went black once or twice—just for a few seconds, and I found that if I watched any single instrument more than a few seconds at a time I had a tendency to pass out. By constantly shifting my eyes from one object to another, I managed to stay awake, but, believe me, I don't want that 24,000 feet stuff every day. No, suh!"

But now that he's grown more accustomed to it, Starr believes he can push his Sparton up to 25,000 feet without oxygen, "if necessary". Those last two words he added in case any other weather flier makes him go that high to get back the record. As matters stand, he's perfectly contented to loaf up to a mere 20,000 or 21,000 feet to earn his thirty odd bucks.

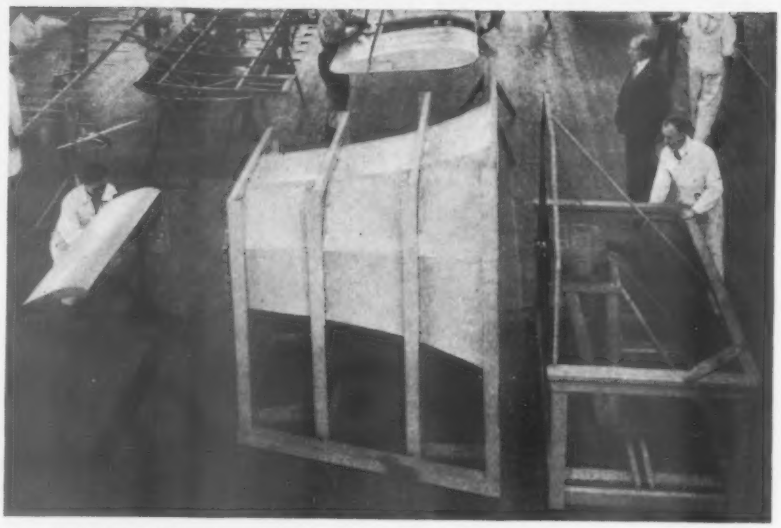
Starr carries a radio in his plane to listen for weather reports from the weather bureau's airway radio station at Fort Crook, 15 miles away—that's paradoxical, isn't it—a man going up four or five miles where the weather actually is and then have some bloke on the ground 15 miles away tell him, or try to tell him, what's what.

On more than one occasion Starr has come down out of the clouds far from his starting point. Once he came down over a town whose railway station said "Oakland", and Starr, thinking it was Oakland, Ia., some miles east of the Omaha field, pointed the nose of his ship west and gave 'er the gun. The weather wasn't any too good and a heavy snow covered the ground.

An hour later Omaha had not popped into sight and his gas tanks went dry. He landed in a farmer's stubble field and found out, much to his surprise, that he was 95 miles west of Omaha. Putting two and two together, he finally figured it out that it had been

(*Continued on page* 401)

Wind Tunnel Plays Important Part in Course



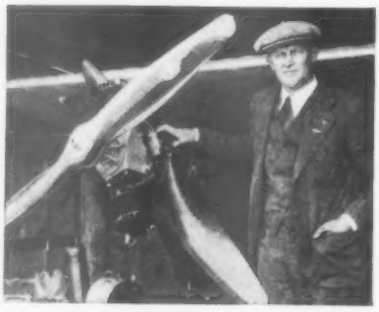
Layout of the wind tunnel used at a large aeronautical school. The motor and prop are at the right, the tunnel is in the center and the test surface is at the left.

HERE is a typical airplane laboratory, such as is to be found in some of the better flying schools. The students are trained in making, testing and designing all parts of airplanes.

The wind tunnel is of especial interest. Here the students are able to make wind tests of the various parts of a plane. It is small and portable, making it more convenient than the large tunnels frequently used. Although it is not as accurate as some of the large ones, it is sufficiently so for the needs of the classrooms.

The wing section under test is at the left of the tunnel, while the blower and motor are at the right.

A New Tandem Propeller Drive Is Interesting



Showing the arrangement of the oppositely revolving tandem props and the special engine.

BASING his invention upon the law of motion that states, "For every action, there is an equal and opposite reaction," Charles L. Brown of Rushville, Mo., recently obtained a patent upon an airplane which features two propellers.

The device has been successfully tried out on a small plane which Mr. Brown constructed himself. The machine weighs less than 300 pounds and is powered with a Heath B-4 type engine made from a motorcycle engine.

According to Mr. Brown, the invention will do away with vibration and torque and tends to produce slower and more efficient propeller speed in ratio to the engine speed.

"With a propeller mounted in front and another behind, the engine turns relatively in both directions at the same time. The crankcase and cylinders move the rear propeller to the right while the crankshaft turns the front propeller to the left," explains Mr. Brown.

"The engine is mounted on a shaft with two ball bearings—free to revolve—with one propeller on the crankshaft and the other on the engine mounting. The latter is attached to the crankshaft and cylinders. The pitch of the two propellers is exactly opposite, so the engine produces nothing but a straight forward pull."

This combines the old rotary type and the new radial type engine. The plane has the same crankshaft operation as at present, only the second propeller is added.

The Missouri inventor is now engaged in building a larger plane, on which he will mount an 88 h.p. five-cylinder engine.

While the tandem propeller is not an entirely new idea, for several were built prior to 1914, yet the constructional details shown here are novel and may eventually work out successfully.

The troubles previously experienced were due to the fact that the rear propeller worked in disturbed air, hence its efficiency was reduced considerably. In one tandem machine, the rear propeller was made larger than the front prop to compensate for the loss.

XUM

Taxing Property from the Air

by RUEL McDANIEL

Airplanes are now making life miserable for the tax-dodger. County assessors are able to prove or disprove property valuations by means of aerial photographic maps.

A photographic map, taken over the suburbs of a city, shows every small detail clearly and with great accuracy—even to highway construction.

VEHEMENTLY, a farmer pounded the table around which sat the members of the County Commissioners' Court, temporarily acting as a board of tax equalization. The farmer had received a notice from the Court, asking him to appear and show cause why the valuation he had placed upon his farm should not be raised.

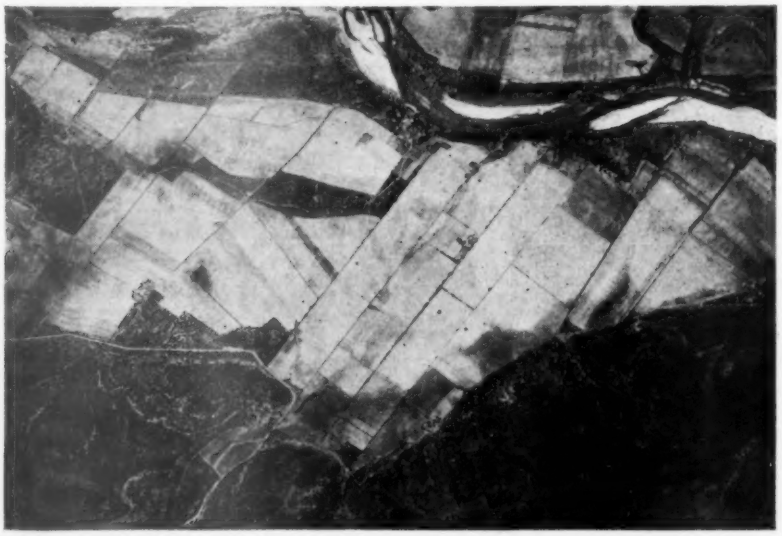
"It's an outrage!" the citizen stormed. "You men are becoming tyrants. My taxes are already too high; and now you threaten to raise 'em still higher. I tell you, I won't stand for it!"

The County Judge, sitting as chairman of the Commissioners' Court, listened attentively, a bland smile playing about his mouth. One commissioner winked at the others. The outraged taxpayer eventually exhausted his vocabulary and his temper. Then the chairman said: "You're correct, Mr. Knight; we are going to raise your taxes. We are adding one thousand dollars additional to the valuation you placed upon your farm. We ought to make it fifteen hundred—it will be that next year.

"You've been listing your property, year after year, and we have been accepting your own valuations, except in rare and unimportant details. We have tried to be equitable and fair to all citizens and we have expected the same of them. . . . Why did you not make mention of that five-acre citrus fruit orchard with its four hundred bearing trees?"

The farmer's face turned a peculiar color. That citrus orchard was on a far corner of his place—nearly a mile from a highway. To his knowledge, no representative of the county had inspected his farm. He had thought the two and three year old orange and grapefruit trees were his official secret. Gradually realizing the full import of the situation, he was willing enough to accept the thousand-dollar raise in valuation.

Locating that discrepancy in this farmer's tax list had been a surprisingly simple matter. It had been uncovered in a few moments, without any representative of the Commissioners' Court leaving the court house.



This photographic map shows the layout of the fields and orchards of a large farm. By a map of this sort it is possible to determine what fields are under cultivation and even the nature of the crops and orchard trees.

IT WAS simply a matter of looking through a magnifying glass at a huge aerial photograph of the county, hanging on the wall in the office of the Commissioners' Court. There stood citizen Knight's citrus orchard in all its beauty and productivity—for anyone to see. Being familiar with citrus fruit trees, the members of the Court were able to calculate the age of the trees, and knowing the exact scale of the picture, they were able to figure the exact size of the orchard.

This case illustrates only one of many hundred of ways that county officials are using aerial maps for better county management. True, the idea is new, only a few counties in the United States having tried it. But wherever in use, the system is reported to be performing with a remarkable degree of efficiency.

A county in Southwest Texas was among the first to have a picture taken of itself. County officials declare that, although some of them were skeptical at first as to the practicability of the system, it has paid for itself three times the first year it was in use. The initial cost was $60,000.

Mapping, for county management, follows along the general lines of other

fields of aerial photography. Flying photographers simply go aloft and take a series of consecutive photographs of the landscape at the same altitude and angle. The ideal altitude is 10,000 feet. This gives the picture a scale of 1000 to 1.

With pictures taken of every foot of area below, the map-makers assemble the hundreds of "shots". They cut and arrange them in their proper order, thereby forming a complete picture of the entire county. It shows, by the aid of a magnifying glass, every road, trail, stream, fence and detail of the entire county. It is a complete picture map of the county.

One county desired to survey a new highway through a low-lying area containing much swamp land. The aerial map had just been completed. The county engineer, county commissioners and others concerned with surveying the proposed road, simply referred to the aerial map and selected, beyond any doubt, the logical route for the highway within a few hours.

It would have taken weeks to have sent men into the district to select the route, because it was not only low and swampy, but the vegetation was dense and the going would have been extremely difficult. County officials declare that the air picture enabled them to select in a few hours a route that was superior to anything that ever could have been laid out by engineers in the field.

THE aerial map is in daily service, not only in planning highway routes and changes, but in routing traffic through towns. The picture shows at a glance the logical streets that through-town traffic should follow, and markings can be made accordingly.

The county's picture saves time and money in laying out drainage canals and irrigation systems, because it shows the depressions, the elevations and the general routes of ravines and streams.

(*Continued on page* 404)

This peculiar photograph shows bushes and underbrush growing in the foot-hills of California.

Udet, German Ace, Is a Premier Stunt Flyer

Here is Udet in the act of picking a handkerchief off the ground by a hook extension on the end of the wing. This is cutting things a little too close for comfort.

UDET—a popular German stunt flyer, must have been reading some stories of our old Southwest during the days when the cowboy was King.

We have just received this photograph, showing him as he adapted the old cowboy stunt to his airplane. An iron hook on the wing tip is used to pick up a piece of cloth, lying on the landing field of an airdrome.

Avoiding Accidents at the Air Schools

THE student pilot was bringing his ship in for a landing. The engine was throttled and he was gliding along smoothly about two hundred feet from the ground. Suddenly a "bump," or convectional air current, caused the left wing to drop. The student quickly pushed the stick to the right to bring the low wing up.

To his dismay, the low wing only dropped further away from the horizontal, and the nose swung rapidly around to the left. In an instant the plane was spinning—completely out of control. It struck the ground with a sickening crash. Another student had paid the high price of inadequate instruction.

The training of airplane pilots has made rapid strides within the past few years, but instances such as that related are still all too frequent. The student in this case had been sent up solo before he had been thoroughly taught the fundamentals of maintaining equilibrium and control.

He had never been shown how opposite rudder should be applied with the ailerons to counteract the increased drag in bringing up a low wing; nor had he been taught how to recover from a tailspin—vital points for every pilot. Instead, he had been allowed to fly alone as soon as he had successfully negotiated normal take-offs and landings. As was demonstrated, this is not sufficient. No student pilot should fly an airplane by himself until he is fully capable of meeting those emergencies which are most likely to arise.

Ever since the post-war period of barnstormers, irresponsible operators without fixed base or capital have presented a major problem in aviation. They have flitted about the country in their planes of ancient vintage teaching people to fly after a fashion.

MOST of them have charged a fixed price, which is based upon a definite period of instruction. At the termination of this, regardless of the student's ability, he is sent up solo, either to become a pilot or an occupant of a wreck.

The Aeronautics Branch of the Department of Commerce is championing the cause of proper instruction, both in ground work and in actual flying. However, it has only authority to grant its "approval" to a school when a school desires this distinction and can meet the requirements.

It cannot force all schools to maintain the standards which it recommends. This responsibility lies with the states, and they have been woefully lethargic in awakening to its importance. At present, out of 303 established schools in operation, only 32 are approved by the Department of Commerce.

(*Continued on page* 390)

XUM

Why Metal Airplane Parts Fail in Use

LIEUT. LAWRENCE A. CLOUSING
United States Naval Reserve

A simple but accurate article treating of the fatigue of metals, crystallization and failure of airplane parts. Illustrated by microphotographs.

WHEN you next see a streamline wire or strut break, before saying that the failure was due to crystalization, stop! Do you know that all metals are composed of crystals, and that the word crystalization as applied to a failure has no meaning to the modern metallagrapher?

What is meant by crystalization when speaking of failures in that term?

What is probably meant is that through vibration or strain the crystals in the metal have grown in size and in the process they have made the metal weak. This is not true. The crystals of a metal do not grow in size under repeated strain or vibration. They do grow in size under certain conditions, but this always involves higher temperatures than are encountered in ordinary use. Temperatures high enough to affect the crystal structure of some compositions may be reached in an aircraft engine, but there, of course, the manufacturer uses only those materials which are not affected.

Fatigue failure is the correct name for many failures called crystalization, but before taking up the explanation of that type of failure let us look a little into the crystal structure of metals.

Sooner or later, everyone connected with the flying game will bump up against an example of the so-called "crystallization" of a metal part. Crankshaft breakage is very frequently due to defects that are clearly explained in this article.

Here we see examples of metallic crystal arrangements as indicated by microphotographs. The structure of the various metals is curious and highly interesting, particularly when one considers their practical application to aeronautic construction.

All metals are composed of crystals. These can easily be seen when the sample is properly prepared, usually by polishing very smoothly and then etching with some chemical, for observation under a microscope. Some metals are more easily observed for crystal structure as for example the metal composition which appears in Figure 1.

Although this is not a composition used in aircraft, it illustrates a basic form of composition of two metals. It is composed of cadmium and zinc, at four different composition percentages. From the molten state the samples have been cooled slowly so that the crystals become larger than they ordinarily would. It will be observed that for each composition there is a different crystal structure. These samples have been magnified 100 diameters.

In the 90 per cent cadmium and 10 per cent zinc photo, the large white crystals are cadmium and the dark background is a mixture of zinc and cadmium, in a form called a eutectic structure. This eutectic structure is such a composition of two metals that both solidify simultaneously when cooling from the molten condition.

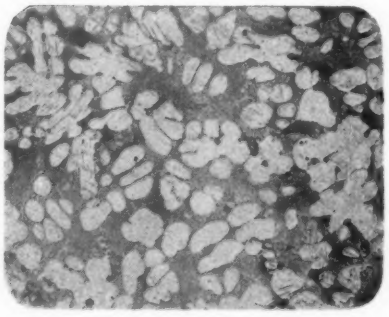


Fig. 1. An alloy consisting of 90 parts cadmium and 10 parts zinc.

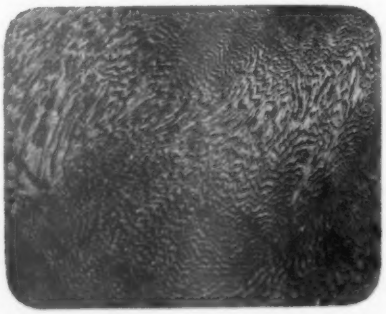


Fig. 2. An alloy of 82 parts cadmium and 18 parts zinc.

USUALLY in compositions of two metals, one metal will solidify first during cooling. While this one metal is becoming solid all of the molten metal remains at the same temperature, just as water when forming into ice remains at the same temperature till it is all frozen.

After this one metal has cooled then, we have part of the metal as a solid and part as liquid. This is just what happens.

Upon further cooling we then come to a temperature at which the remainder of the metal solidifies, and all the composition again remains at a constant temperature until all the metal is solidified. In the case of the composition here taken up and in many cases, of course with certain modifications, this remainder to solidify is the eutectic composition instead of one of the metals.

It so happens that in the case of many compositions of metals that they will be soluable in each other in the molten state, but that upon solidification they are not soluble, and separate from each other. This is true of the sample here shown. The crystals are each of the one metal only. Even the eutectic structure is made up of alternate layers of zinc and cadmium, which is best illustrated in the 82 per cent cadmium and the 18 per cent zinc photo.

In the 50 per cent cadmium and 50 per cent zinc structure the dark crystals are zinc, and the white background is the cadmium-zinc eutectic. Here the crystal structure is very marked.

At 10 per cent cadmium and 90 per cent zinc the dark parts are zinc and the white is the cadmium-zinc eutectic.

The fact that in compositions of metals the different crystal structures solidify at a constant temperature en-

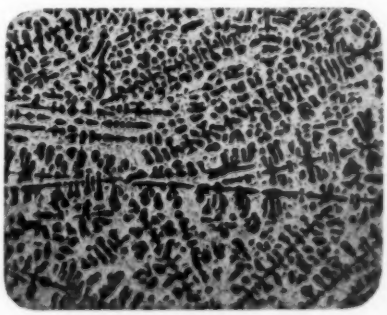
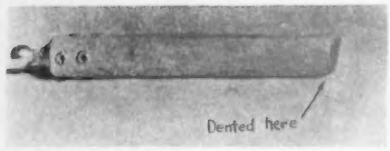


Fig. 3. Curious structure of alloy consisting of a 50-50 mixture of cadmium and zinc.

Fig. 4. This alloy contains 10 parts cadmium and 90 parts zinc.

ables metallographers to chart melting and solidifying temperatures of the whole series of compositions of two metals for all possible percentages of composition. This chart is called a constitution diagram.

For the composition given this is a relatively simple diagram, but the constitution diagrams of steel, which is composed of iron and carbon, and for duralumin, which is composed of aluminum and copper mostly, become much more involved, and will not be gone into here. Principally the difference lies in the fact that these metals also undergo changes in crystal structure in the solid state, which are also shown on the constitution diagram.



The broken landing gear strut.

To the worker in metals these constitution diagrams are what charts are to the navigator; they enable him to plot his heat treatment of steels and dural or other metals so that he will get the properties from it that he wishes.

Crystals not only form for compositions of metal, but also for a pure metal, or for metals that are soluble in each other in the solid state. Solidification will start at one little point, and the crystal will continue to grow, while other little crystals are also forming all over, until they finally all meet and leave between them a sort of boundary layer, which is called the crystal boundary.

The size of these crystals depends a good deal upon the type of metal with which one is dealing, upon the heat treatment it is given and upon the working (such as rolling or stamping) received. To get the proper strength from a material, especially steel, the right kind of crystal structure must be obtained. This is merely another way of saying the proper heating, annealing, quenching and drawing must be given to it.

WHEN it is given the proper heat treatment, the crystal size is usually quite small. When not, the crystals usually are larger. When the crystals are larger the metal is generally weaker. Heating as in welding will cause the crystals of the metal to grow near the weld, which weakens it more than the metal of the weld itself is weakened. (This accounts for the fact that failure of a welded part generally occurs just outside of the weld rather than in the weld.)

Thus if we have a part that fails, it is most apt to fail at a point where the crystal structure is large to begin with. A person observing such a part and seeing the large crystal structure would say the metal had crystalized, when from what has gone before we see that all metals are crystalline when they are in the solid state.

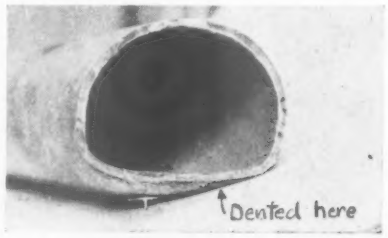
What is commonly called crystalization often comes under the class of fatigue failure. Failures of this type occur in a member that is under reverse stresses such as an axle. A nick or some imperfection may exist in the metal. As the axle rotates carrying a load, the stresses at the point of the nick are higher than at any other place in the axle. The stress at this point then distributes itself amongst the surrounding material, but as this process goes on many, many times, it may happen that the stress sometimes exceeds the elastic limit of the material, and it yields taking a permanent elongation. This elongation is, of course very small.

When the yield point is exceeded, however, each time the stress is applied it deforms a little more, till finally a little crack may form at the base of the nick. From then on the progress of the failure is very rapid, whereas the time that it takes to lead up to this point may be very long. When the crack is formed each reversal of stress then may make it a little deeper till finally a point is reached at which it fails altogether.

A fatigue failure break has generally a patch of bright polished metal, and then a patch of coarse metal. The shiny part is where the crack has been, and is due to the two ends of the metal rubbing against each other, thus polishing the crystals. The coarse part is where the final failure occurred and reveals the crystal structure as it is.

Strange as it may seem, in fatigue failures the more ductile materials are the ones more liable to failure from this cause.

THE author personally is well acquainted with a fatigue failure in the landing gear strut of a modern airplane. Due to a previous failure of a bolt in the landing gear, the strut received a dent, which left a rather sharp nick, as shown by the arrow in the illustration of the side view of the strut, at the place where the break occurred. Otherwise the strut was in good condition. There were no spare parts around when the strut was dented, and it would take some time to get a new one, so this strut was kept in the landing gear assembly. No



End view of the landing gear strut showing the dented portion.

(*Continued on page* 397)

A New Human Bird

Will it fly? Well, your guess is as good as ours.

WILLARD E. BLAIN, New London, Conn., plans to take-off in this queer looking airplane. It is his own invention and he calls it a man powered ornithopter. It has a wing spread of 22 feet and weighs 40 pounds.

Mr. Blain plans to take off in a 25-mile wind during the trial flights. Wing movements are controlled by the movements of his arms, the tail being controlled by his feet and legs. In flight, the pilot's body is horizontal like that of a flying dove.

New Compass Tells All

The versatile compass that promises great things in the science of avigation.

WARREN S. EATON, pioneer aeronautical engineer, has recently announced his newest invention.

It is a compass that is expected to supplant several instruments now in use.

Among its various abilities it determines the position, not only in relation to the map, but also with regard to other aircraft.

It also indicates elevation above the ground, position in relation to a regular flying route, determination of wind direction on landing, and the various needs of blind flying.

Officials of the U. S. Army Air Corps are reported to have said that they expect the device to supplant many of the instruments now in use.

The instrument is primarily a radio controlled device. A simple radio set is tuned to the proper station. When the signal is tuned-in, the compass needle indicates the direction of the incoming radio wave.

In case of a storm, the pilot can circle the dangerous area, and still keep his bearings.

New Uses of Electricity in Aviation

A brief summary of important yet little known electrical devices that have been applied to aeronautics during the past year.

NEW aeronautic devices developed and put on the market this year included the sonic altimeter, automatic steering control, code beacon flasher and hangar-interior floodlight. A tachometer, oil pressure indicator and fuel pressure indicator—all electric instruments—were made practical and put into regular production.

Just as with the automobile, electrical devices are rapidly gaining favor in aeronautics for various purposes. At first, the use of electricity was largely confined to the lighting circuits of the planes and to the ignition system. During the past year it has found a number of new applications, largely in the operation of control systems both automatic and manual.

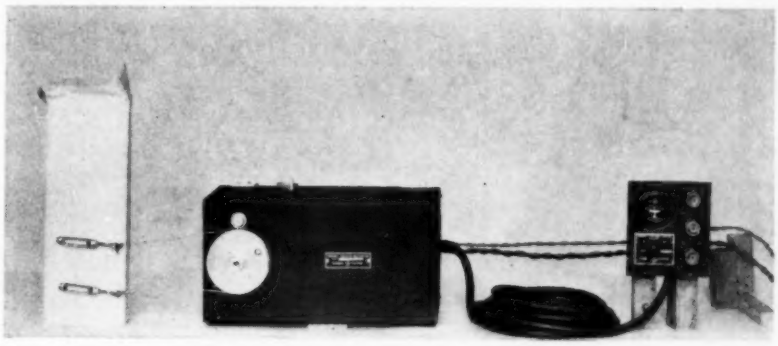
Electricity is of particular importance where energy is to be conveyed from one part of a control system to another, the two or more parts of the device being remote from each other.

The sonic altimeter is an interesting application of the principle of sound echoes used for indicating the distance from a reflecting surface. The sound signal is a high frequency whistle note which is emitted downward toward the earth from the aircraft while in flight.

The earth acts as the reflecting surface and the echo is received in the aircraft after a definite interval of time. This is a direct measure of the height of the aircraft above the earth. The instrument is used as a "depth-sounder" in regular flight for heights up to about 1,500 feet, and also as an indicator of approach to the ground when making a landing.

The new automatic steering control operates the rudder of an airplane so that the course of the ship is in accordance with the setting of the magneto compass. A turn compensator is provided to correct for the inherent turning errors of the compass, keeping the line of flight as near a straight line as possible.

Means of correcting for wind drift by visual and radio devices have also been produced. These will complete the General Electric system of directional control, making possible any desired flight track over the earth and the arrival at a destination in fair weather when the ground cannot be seen.



An automatic steering control, electrically operated, shown in diagramatic form with the rudder at the left, control at center and compass at the right.

Here is the motor driven compass generator used in the operation of electrical compasses.

A new visual drift-plate for measuring the angle of wind drift in flight was also perfected, and several improvements appeared on equipment already on the market. Among these were the electric motor drive and new indicator for the magneto compass, a stronger and simpler selector switch for multiple thermocouple installations and the use of a sword-shaped pointer and shock-absorber mounting on engine temperature indicators.

Wing-edge landing lights, with their desirable characteristics of completely built-in-the-wing construction and light weight, were redesigned so as to simplify installation.

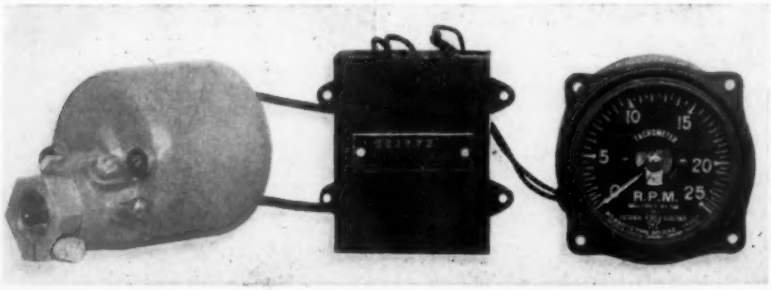
While there were no radically new developments in superchargers, their use as standard equipment on aircraft engines continued to become more nearly universal. Several new manufacturers were added to the list of those already using centrifugal superchargers built-in as an integral part of their engines.

The new code beacon flasher is for use with standard electric code beacons for flashing dash and dot signals. It consists of a motor driven gear and cam mechanism operating a contactor. Periodic light signals are sent out to identify airports and intermediate landing fields.

It is customary to flash the code letter assigned to the particular airport and intermediate field by the Department of Commerce. For instance, the letter designating the Schenectady Airport is "S" which is represented by three dots flashed at regular intervals by the code beacon controlled by the flasher.

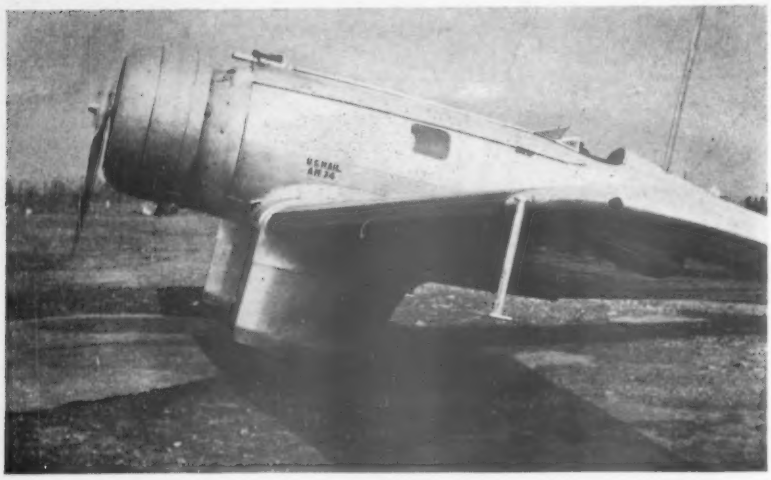
The hangar-interior floodlight is intended to supplement overhead lighting inside hangars. It is furnished in two sizes, one using a 1,000 watt lamp and the other a 500 watt lamp. By means of a Fresnel lens, the light is distributed smoothly and efficiently throughout approximately 180 deg. in the horizontal plane.

END



The tachometer generator is shown at the left (driven by the engine) while the tachometer dial at the right shows the engine speed in revolutions per minute.

This Monoplane Is Equipped With "De-Icers"



Rubber tubes along the leading edges of the wings eliminate ice coatings.

FIRST commercial installation of aircraft "de-icers" on a cabin plane was recently completed at Newark Airport by engineers of several interested companies.

The rubber appliances, developed after several years of experimentation, eliminate the formation of ice in flight when compressed air is automatically released into special tubes along the leading edges of the wings and other surfaces.

Following the "de-icer" installation, a flight test was made at an altitude of 10,000 feet where heavy ice was encountered and successfully removed.

Laws That Affect Amateur Aviation

by LESLIE LONG

THE adoption of Federal requirements by a majority of the states, presents a serious menace to the future of private flying. If these requirements are not changed, or the states make less stringent regulations of their own, there can be but little hope for a flying public.

The only really airminded men in this country are the ones who have built, or are building, or hope to build, airplanes of their own. There are several thousand and practically none of them have either the desire or the money to buy a factory built plane. Instead they have the inborn urge to build something newer and better. They belong to the same group of tireless experimenters that has made radio what it is today.

The demand for a Federal license simply means—prohibition. No ordinary experimenter can afford a stress analysis. Neither can he afford the endless red tape necessary to have his ship passed upon. Let's make this perfectly plain.

The amateur builder can not meet the present Federal requirements. If he is forbidden the right to do experimental building and flying he is going to lose interest and quit aviation forever. There is no question about this; it is being done every day. It means that thousands of dollars are going to be lost by the flying schools and that supply houses and parts makers are going out of business.

Whether or not these laws are unconstitutional has not been settled. They probably are, but whether they are or not, they are certainly not justified. The safest airplane ever built is the so-called light plane. Any examination of records will show this. Hundreds of these light planes are flying every day and serious accidents rarely happen. The reason, of course, is because of the light loading and the tendency to stay on the ground in bad weather.

The argument that regulations are made to protect the lives of our young men is nothing but hypocrisy. Hundreds of boys are killed every year in racing cars and motorcycles and no laws are passed about it. You may go out and break your neck on the football field and become a hero, but if you have the courage and ability to build and fly an airplane you are a felon, and subject to prosecution.

A tragic side to these unjust laws is that they are passed by men who have no knowledge of what they are doing. They are told this and that, and act accordingly. Commercial interests have as a general thing fostered these laws, under the mistaken impression their business would be helped. Nothing could be farther from the truth.

If these young men were allowed to

(*Continued on page* 392)

Liquid Fuel Drives Rocket

THE idea that a rocket is the only practical means of penetrating the stratosphere continues to receive the attention of our scientists.

In the past years, various types of fuel and design have been used. To date, what success has been obtained is very mediocre. Whether the weakness has been in design, fuel or basic idea, seems to have caused little or no worry. If a particular one does not work, a new design or a new fuel combination will be quickly proposed.

The latest idea is being backed by the American Interplanetary Society, an organization of rocket experimenters with headquarters near Red Hook, New York. The rocket is seven feet tall, built entirely of aluminum and uses liquid oxygen and gasoline for fuel. The rocket will be shot from a firing stand which guides it for the first thirty feet. At the highest point of flight, an automatic device will open a parachute and the rocket will descend to the earth gently for another trial.

A larger rocket is to be designed this summer or next fall if this small one proves satisfactory. This larger one will carry instruments for obtaining meteorological data and photographs.

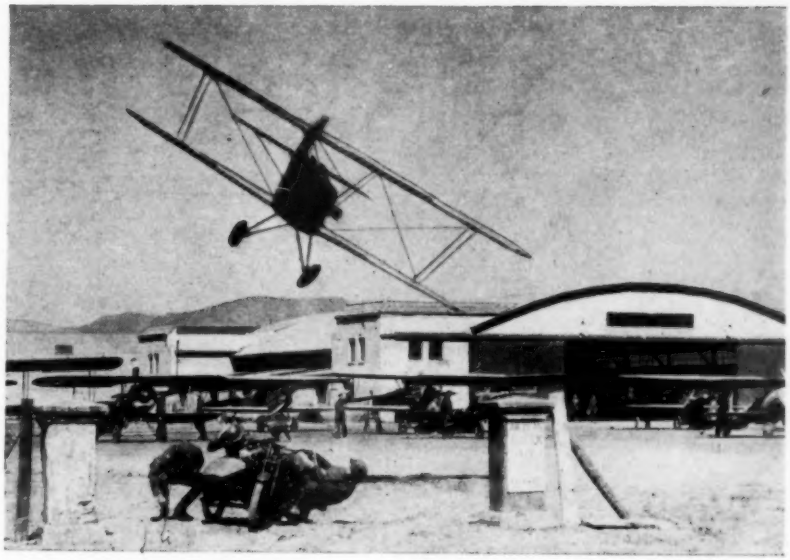
The present rocket was designed by G. Edward Pendray and Franklin Pierce, rocket engineer. The rocket is now being tested for strength and balance at the Physical Laboratories at New York University. Trials will begin at the proving ground when these preliminary tests have been made.

The completed long range rocket that promises to show superior performance.

Dodging Wires Is No Joke!

by CAPT. CHARLES W. PURCELL

Obstructions frequently found around airports are a direct menace to life, limb and property. Says Purcell, "There should be a law against them."



A fine example of hopping around the obstructions found around the small-time airports.

WIRES! High, low, big, skinny or otherwise!

Did any of you Bimbos ever approach an airport just about sundown and figure everything was rosy as you picked up a wing and started to gently slip into a field, and then, all of sudden find a mess of wires about three feet below you. Huh, did you?

Do you remember how you felt as you kicked out of that slip and blasted the drag on your controls, as you eased back on the stick and waited to see if your landing gear was going to clear? Huh, do you? Do you remember that grand and glorious feeling when you cleared those said wires by inches? Huh, do you? If you happen to be one of the few pilots in this country who have missed this thrill of thrills, don't get chesty about it, you have one coming up, and when it comes you will have knocked at the Pearly Gates and found nobody home, for which you can be duly thankful—there is another place besides heaven.

We, the combined flyers of the cockeyed world, would like to know why wires are necessary around landing fields. At a small cost these aids to suicide could be buried, along with other so-called aids to civilization. Wires, tall power poles of every description, unnecessarily high advertising signs, and anything else that sticks up more than ten feet around the approach to a field should be removed by legislation. The men who make our laws, as a rule are not flyers, but there is no reason in the world why pilots cannot get together and show these same lawmakers why these things are a danger to life and property. Take them for a ride, and bring them in close to these obstructions and the author thinks there will be no trouble getting laws necessary to remove the difficulties.

One law man in California, the Honorable James Rolph, Jr., Governor of this land of sunshine, who does all his traveling by air, was taken close to some wires quite by accident, and ten days later the wires were in the ground. It happened this way.

The Governor was coming in from Los Angeles in a tri-motor and he arrived at a certain airport in the Bay District of San Francisco. Shirley Bush, the pilot, was coming in under a low ceiling just about dark, that period of the day when flying is not so hot—not dark enough for lights and not light enough to see distinctly. In this case Bush knew the wires were there, and their exact location, as this field was his "home", but the Governor had no way of finding out if Bush could see the same things as he did as they approached the field. Nearer and nearer came the field, and the same goes for the wires. The Honorable James Rolph must have thought his time had arrived.

TO THE layman, or public at large, a ship approaching wires, always comes too close for comfort, and the governor at this time was a layman. Bush cleared the wires by fifteen or twenty feet and landed on schedule. When the governor, (who is called Jimmie on every airport in the state), climbed out of the ship, he asked Bush why he came so close to the wires. Bush explained that he was just under the ceiling, the dangers of over-shooting if he approached the field at a higher altitude, and the danger of getting lost in the cloud formation above the field if he climbed above the ceiling. Jimmie Rolph listened very attentively. When Bush finished his explanation the governor said, "That will have to be attended to."

Ten days later it was. The wires now repose some sixteen feet under ground, where some bird said all good Indians belong, and wires should be with them. Rolph never says much but he surely is a cyclone for action. Today he is a pilot, one of the brotherhood, and he is doing more for the flying game than any governor this state has had to date. A pilot can bust into the governor's office at Sacramento with a tale of woe, and if the tale is reasonable, the woe is removed, but the tale travels on, an example for other legislators.

This is cited just to give some of you Bimbos an idea as to how to go about removing obstructions from flying fields. Non-flyers have no way of knowing the thrill that field obstructions can give to a pilot. They have no idea of the chills and jitters that a mess of wires can give, when said wires loom up just ahead and below Mr. Pilot—and not far below.

FOR the benefit of these said non-flyers, we'll try and take you on a mental flight. Here goes.

Just for the sake of argument we'll say you have just finished your "steenth" hundred miles of flying and the sun is going to the place where all good suns go when the day is done. There is an emptiness in the stomach and a stiffness in the joints. It's just about time to find an airport and get some chow and a bunk for the night.

You mentally chase over the airports near, and decide to land at Gedunk. Now you have never been in Gedunk, but it is known by "moccasin wireless" that it has all the things that a good field should have—hotel, shops, and a good chow house. It should be right below now. A glance over the side shows it, off to the left a little way.

The sun is just about ready to sink below the horizon as you approach the field and spot the wind-sock for the wind direction. Everything looks to

be all right. The field is empty, and in the half light nobody else is trying to get into it.

You may be a little high to get in and in a hurry to land. In this case you'd slip rather than circle the field to lose altitude. The gun is cut, the right wing goes up, a little right rudder, and the plane gently slips into the edge of the field. (This doesn't go if you have a Hisso power plant).

As you are slipping in thoughts of eating, and just how good a bed is going to feel, when—Zowie!—a mess of wires, big ones, sneak out of the ground shadows just feet below and just feet ahead. All thoughts of food and bed leave your mind. You pour the can to her, straighten out and give the ship all the back stick she can take, and then sit and wait.

Ladies, gentlemen, and fellow citizens, if I could talk for the next three thousand years, I could never give you the feeling that the next few moments bring to a pilot in this predicament. Seconds grow into years, the body acts only from experience it has accumulated in hours of flying. Your hands have made the necessary control and engine corrections, but the brain has suddenly gone bye-bye for these few seconds. This is due to the total surprise you received in finding wires where no wires were visible a few moments before.

The late evening light is the light that lies, and lies, and lies, (not the light in a woman's eyes). Many a pilot has cracked up a landing gear in this light and has wondered why he "flopped" into the field from fifteen or twenty feet when he thought he was on the ground.

A real old timer in the flying racket "feels" into a field at this time of the day. All sense of perspective and distance seems to leave a human at this time. Just as the sun is going down it is too early for ground lights and too dark to pick things out of the shadows. Objects in a field suddenly loom up when one gets ready to "put down" and that's usually too late.

NOW to get back to our story. Can you imagine how you feel when the wires are cleared by inches. You may think so, but the author doubts it very much, unless you have been in this predicament. Money from home, a million dollars inheritance, four aces and a joker in a poker hand, and thirteen spades in a bridge hand would give no feeling that would touch this one. When you finally realize that the plane has cleared those wires you could kiss your worst enemy. You feel so good that you would probably kiss the super of the airport. If the same wires had been missed by a wider margin, that same super would have received the bawling out of his sweet young life.

This brings to mind a little story. I can't mention names in this case because if I did, somebody would be patting me in the face with a spade.

(*Continued on page* 396)

Report on Slotted Wings

THAT slots and flaps in the wings of airplanes "represent one promising method" of increasing safety in flight was a point in the recent report by the National Advisory Committee for Aeronautics after a series of severe tests.

Experiments with a 110-horsepower monoplane weighing 1,800 pounds showed that without the slotted and flapped wings the landing speed was 60 miles an hour and that with those safety devices the speed at landing was reduced to 43 miles. At the same time the angle of landing was steepened from 13 to 17.2 degrees, thus indicating, in a sense, how small landing fields may be utilized with a minimum of hazard. Without the slots and flaps in its wings the machine took off at 55 miles an hour; equipped with the safety contrivances the speed was cut to 40 miles.

Their use, according to the report, enables the pilot to retain control of his ship to and beyond the "stalling point", that is, where flying speed is lost, thus increasing the efficiency and safety of the machine.

New Guide for Pilots

Wind sock looks like serpent.

NO—THIS is not a flying torpedo—nor the latest stratospheric plane. It is the latest form of the familiar wind-sock.

This wind-tee, as it is called, is mounted at the Central Airport, Camden, N. J. Special design makes it very sensitive to the slightest variation of wind. In addition to wind direction, it gives the wind velocity.

The row of lights on the top are controlled from the local air station at the airport. The number and position of the lights illuminated gives the information.

Special illumination and coloring effects make this wind indicator visible for over three miles.

And This Changes Our Idea of the Orient

PERSIA is regarded as a land of desert and heat, but the past winter was so stormy and snowy that even the airmail was interrupted. Although planes were able most of the time to operate on schedule between Bagdad and Teheran, other points on the airmail line were inaccessible because the landing fields were buried deep in snow.

Hip Hola Minewawa

Capt. Frank Hawks in his war bonnet.

CAPTAIN FRANK HAWKS is now a member in good standing of the Sioux Indian Tribe of Hot Springs, S. D. His Indian name is Chief Flying Hawk.

All these feathers must have given him kuish (or what is the Sioux for "pep"?) for the next day he established a record between Chicago and New York, of 3 hours, 46 minutes.

Perhaps it was the feathers that gave him the inspiration, for shortly after that he established a record between Hot Springs and Roosevelt Field, of 8 hours, 48 minutes.

What power these Indians have!

Kinner Airplane

A FULL-SIZED 100 h.p. low wing airplane, featuring a folding wing mechanism and side-by-side seating for two that will sell at a startling price well under $2,000, is announced by the Kinner Airplane & Motors Corp.

The ship will be powered by the Kinner 100 h.p. engine and will have a top speed of 110 m.p.h. The folding wing mechanism will permit storage of the plane in a space but 9 feet wide. The normal span is 36 feet. Other features of the ship are dual controls, a unique braking system and outstanding performance, even at extremely high altitudes.

Kinner has been experimenting with the ship for the past two years.

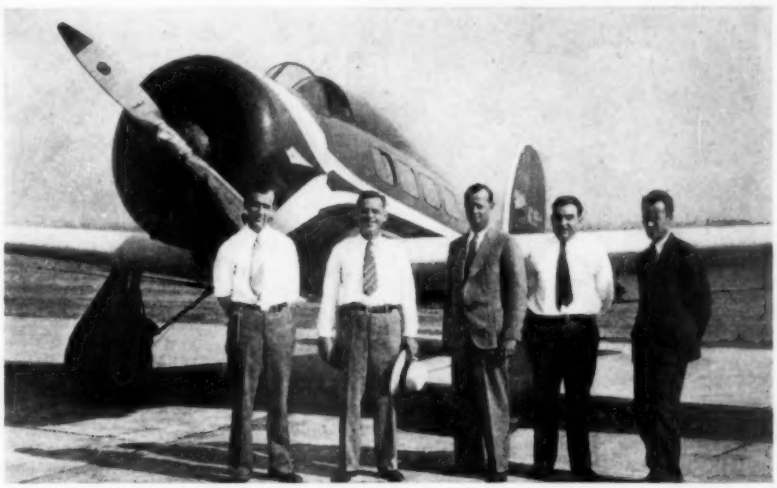
The Kinner monoplane with its wings folded.

A Trip in the World's Fastest Transport

by THOMAS J. FLEMING

How a Lockheed Orion cuts down train time from hours to minutes between Washington, D. C., and Chicago. An interesting narrative of air-travel.

[Model-builders will be interested in the detailed plans of the Orion on page 386. —Ed.]



The ship that makes mincemeat out of space and time, with five of the passengers standing in front of it.

WE WERE streaking it across the sky over Hagerstown, Maryland, at about a 200 mile an hour clip, having taken off from the Washington Hoover Airport, Washington, D. C., just 22 minutes previously. It was on one of the Continental Airway's Wasp powered, six passenger low winged Lockheed monoplanes equipped with retractible landing gear, and modernly equipped in every respect.

The destination of three of our fellow passengers was Pittsburgh, our first stop on this regularly scheduled run to Chicago. The other two men, as well as myself, were holding tickets for Chicago.

One of the Pittsburgh bound men hauled a bottle of aged corn out of a boodle-bag that required no excuse whatsoever. The aroma, upon reaching the pilot led to his quaint remark, that the bottle should be returned to the boodle-bag if it did our snake-bite no good.

In typical Pullman smoking compartment style, the stories started, probably because of the easy socialibility of air-travelers who seem to have a sort of mutual understanding that they are helping to pioneer a comparatively new form of travel. There is an atmosphere of sincere friendliness, the kind that makes you want to know more about the fellow next to you, and when you have reached your destination, it is with regret that you part and hope you may have the pleasure of seeing him again.

This particular plane, in which we are traveling so fast, is the "Orion" model of the Lockheed. With the exception of the floor, the cozy cabin on the inside is just as round as the fuselage on the outside appears to be. The comfortable seats are arranged in three rows of two each, all being adjustable for reclining purposes and also to permit easy entrance and exit.

The interior is finished entirely in a natural tan pigskin leather, indicating the fineness with which the craft was built, while the baggage compartment capacity seems ample to hold a fair sized bag or two for each passenger. The total weight of the ship when loaded is about 5200 pounds. It's useful load is about 2000 pounds.

The engine, humming so sweetly, is the 480 horsepower Pratt and Whitney Wasp. Jimmy Doolittle once remarked, "he'd fly a table if given the proper engine," and if we are to take the words of the flying fraternity, we have one here—stuck right on the nose of this ship. It has "horses to spare," as the saying goes, and so smooth running that conversation was easy when we held our heads fairly close together.

The winding, muddy Potomac, with its hundreds of little islands, was out of sight long ago, and now we are sailing smoothly along over the heavily wooded Allegheny Mountains—one of the rarest and most beautiful sights imaginable. The growth of trees was so dense, hardly a square yard of the soil was visible. Surely, it must be a hunter's paradise. We zoomed over the peaks at an altitude of about 5,000 feet.

It was thrilling to watch the sudden dropping away of the slopes to the valleys as we crossed each range. The realization of height and depth was forceful.

At McConnellsburg, Pa., we bore slightly to the left and followed the general line of the highway that runs into Pittsburgh. The large white letters, "U. S. 30," with the directional arrow indicating the road and direction, was painted on the highway about every ten miles by an airminded roads commission and easily read at 3000 feet. This is undoubtedly a great help to aviators in checking their position.

While the highway took away some of the thoughts of the primeval forest we were flying over, it was interesting to note the lunch stands, hotels, automobiles and people on the top of each mountain. They were probably resting after their long and dangerous pull up the mountain, taking in the sights of the valleys around them. Many of them waved at us.

They bring to my mind the trials and tribulations, the effort, the knocking automobile engine and the stops for water that I experienced a few months previous as I motored over these very mountains. The drive from Pittsburgh to Washington by auto took eight hours, whereas we were now scheduled to make it in one hour and fifteen minutes. The distance, oddly enough, is 302 miles by train and 235 miles by road. The train trip is an all night affair.

We have finally put the last high range behind us, and a town on our left is identified as Greensburg, Pa., by one of our passengers. It is raining lightly. We cannot see the drops, but can see the water streaming back on the wings. Visibility, however, is about ten miles. The terrain is hilly and stunted with spasmodic growths of trees.

Small farms dot the countryside. Mining villages are easily spotted by the rows and blocks of buildings built identically and also by the slate piles. The direction in which the various hills slope is easily determined by the different shades of newly upturned earth and channels, the latter caused undoubtedly by the flow of rain water downward into the small valleys, where the shades appeared darkest. As a river winds its way beneath us, we are informed by the pilot that Pittsburgh is just a few minutes away.

If we had the facilities, there would be no need to wash or tidy up for we are as clean as when we left Washington. I really believe that a man could put on the "soup and fish" in Washington and keep his dinner en-

(Continued on page 397)

What Airplane Manufacturers

by

STUART E. KNEUPFER

The flying season is now on, and with its coming, the manufacturers are displaying their highly developed planes for the season of 1932.

The Ford "Club" ship is an improved and refined edition of previous Ford ships.

Below is an interior view of the Ford "Club" transport showing the seats.

SAFETY—speed—low first cost and economical operation — appearance. These are possibly the major factors for which the aircraft industry has intelligently labored. The results—when compared to the models of two and three years ago—are little short of amazing.

Generally speaking, fundamental structural changes have not been made. An increasing use of metal in construction is immediately noted, with a strengthening of the metal through means of sturdier parts and better compositions of alloys. Brakes have been vastly improved, while the new types of shock absorbers eliminate the severe landing bumps that long remained one of the most unpleasant features of an air trip.

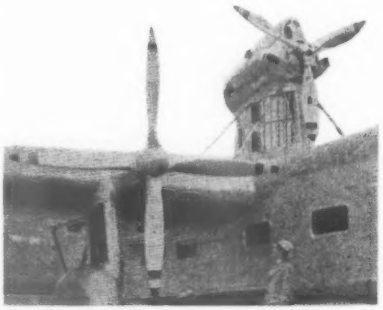
And, when we speak of passenger comfort, we must consider the prevailing luxurious, roomy seating in the open-place sport jobs, the small cabin ships and gigantic transport liners. This is combined with effective heating during cold spells and refreshing cool ventilation during sultry weather. Increased vision and reduction of noise are additional indications of an industry's attempt to reach the various classes.

Probably the most startling of the new planes is the mammoth new Ford, all metal mono-wing transport plane 14-A. This plane was developed to meet the need of de-luxe equipment in long distance transport service. The manufacturer has forseen the demand for night service, and has provided luxurious sleeping arrangements, very comparable to Pullman accommodations on our finest railroad trains.

Built in cantilever style, several unique features are incorporated, chiefly in the method of engine installation. The outboard engines are entirely within the wing, with only the front bearing and propeller bearing exposed.

The center section engine is an echo of the Dornier planes with a pedestal mounting.

The wheel pants, and the method of retracting the wheels during flight, are also attracting much notice. Combined with the retracting gear, is a very efficient shock absorber and wheel brake. The wheel arrangement has another interesting feature. When the plane is resting on the ground, the wheels are retracted into the pants, thus lowering the plane to a horizontal position, making it much easier for passengers to load and unload.



A detail of the Ford Airliner 14-A, showing the power plants.

The pilot is located in the extreme forward part of the fuselage. Adequate space is provided for him and his assistant. A mirror in the roof of the compartment provides visibility overhead to the rear.

Directly behind the pilot is the smoking cabin. A rear door leads to the main cabin which contains four passenger compartments, identical in size. Two lavatories, the steward's galley, a luggage compartment and the main companionway leading to the doors in the rear comprise the interior arrangement of the plane.

The passenger compartments are similar to the arrangements of a Pullman car. The passage way in the middle of the plane divides the compartments into two sections, each with two double seats facing each other. The seats are convertible into sleeping berths. There are no "uppers".

The cabin is very comfortably finished. No structural members are exposed. Thorough insulation against heat and sound is a feature of the construction.

Fairchild has startled the field with a two-place, open cockpit monoplane model, priced at $2,775.00. It is powered with a 95 h.p. Cirrus Hi-drive engine. Several new features have been incorporated in its design and construction, one of which is the use of square section tubing for the longerons and all right-angle members, and round section tubing for all diagonal members.

Square section tubing makes accurate fitting and develops maximum strength at all joints. Undoubtedly, it has helped to eliminate parasitic weight in the fuselage.

The construction of the Fairchild

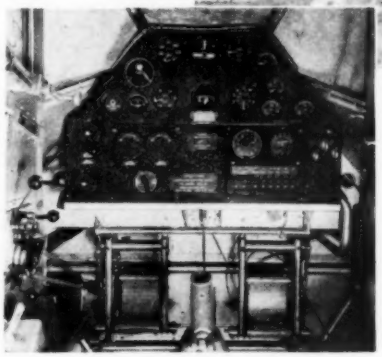
Side elevation of the mammoth Ford Airliner Type 14-A. The long forward extension of the fuselage reminds one of English practice while the pedestal center engine reflects Dornier tendencies. At the time of going to press, this ship has not yet been test flown.

Are Showing for the Year 1932

While there have been no revolutionary changes in the design of the 1932 models, yet refinements in minor details have brought about improved performance, more comfort and a notably more attractive appearance.

At the right is a Pilgrim transport, built for the American Airways. It is an efficient, single engine job.

Below will be seen the instrument board and controls of this ship. The rudder pedals and stick socket are prominently in the foreground.



wings is also worthy of note. The spars are of "I" beam section (one piece) consisting of a center web and cap strips of spruce. These webs and cap strips are spliced at the points of zero deflection of the beam. Plywood gussets are used to reinforce the spars at splicing points.

The spars are inter-connected by a combination of duralumin and built up steel tube trusses and square drag wires, held up at each end by fittings. Reinforcements of extra metal nose ribs are made at the leading edge, which is covered by a formed sheet of duralumin.

The ribs are ¼ inch spruce members, fastened together with plywood gussets. They weigh only 5 ounces each, yet they have carried a load of over 500 pounds. All fittings are cadmium plated and require but little welding. Wings are, of course, wired for navigation lights.

The ailerons extend the full length of the effective wing span and are built of a new metallic composition called "Alclad". Because of the torsional stiffness gained by this combination, the plane has effective control even at low speed.

The ailerons are attached directly to welded steel tube brackets which in turn are bolted to the rear wing spar instead of by the conventional manner of hinging them to a false spar. Each aileron moves 30° up and 15° down.

LOOKING into the cockpits, we find two control sticks mounted on a torque tube, supported by three split cast aluminum bearings, all attached directly to the fuselage rather than to the floor board.

The Taylor "Cub" is a popular type of lightplane.

In order to eliminate the tendency to yaw—prevalent in planes with ailerons of large size—the aileron torque arm is set at a peculiar angle, which is also done with the aileron horn attached to the aileron.

Fairchild have designed their own shock absorbers of the spring and oil type, having a total travel of six inches, the first four inches of this travel going through oil and the remainder cushsioned with springs.

The Fairchild Cabin job, also equipped with Cirrus Hi-drive engine, lists at $3,360.00. It is a two seater with a side-by-side seating arrangement. Two large doors, non-shatterable glass, standard instrument equipment, adequate ventilation system, and exceptional visibility are some of its features.

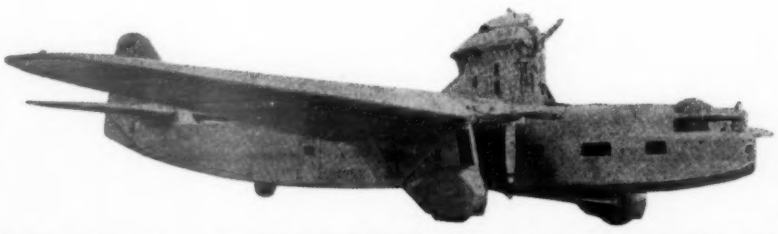
The methods used in painting these planes is representative of that used by the majority of manufacturers—four coats of clear lacquer, one coat of aluminum, and two coats of pigmented dope. Waxing and buffing results in a finish rivaling the brand new family automobile.

The Monocoupe Corporation offers four models, each priced in accordance with the power installation. The choice of the Lambert R-266, Warner-Scarab, Kinner B5 or K5, or the Velie M5 engine gives a price range of from $2,395.00 (Velie) to $4,485.00 (Warner-Scarab).

The Monocoupe, a two-place cabin job, shows radical changes in its landing gear, improved seating comfort, increased visibility, a new system of hot or fresh air ventilation and lighter semi-balloon tires. Operating costs of the Monocoupe are quoted at 2¼ cents per mile, including both fuel and engine maintenance.

AUTOGIROS are stepping up to an enviable position in the aircraft field. Recent production developments have reduced the price appreciably and this type of ship will soon be in the popularly priced class. At the present time, the Kellet and Pitcairn autogiros are being manufactured and sold through dealers.

The former has, as its features, a convertible top, side-by-side, more comfortable seating, ample vision, improvements in actuating controls and engine cowling, the reduction of engine noise and vibration, greater climb and more speed. The Pitcairn is two-place with individual cockpits, dual controlled, a starter, safety glass windshields, roller bearing wheels, parking brakes and



A three-quarter view of the Ford super-transport which shows the engine mountings and the landing gear. The radiators of the wing engines are carried on the upper part of the landing gear.

full instrument installation listed as standard equipment.

STINSON has designed a new airliner, seating ten passengers and pilot. Powered with three Lycoming (720 h.p.) engines, it developes a cruising speed of 122 miles per hour and a top speed of 141 miles per hour. Internal expanding brakes, cabin heating system, non-shatterable cabin glass are features. An ingenious system of mounting large rubber cores on rods bolted to the rear flange of the engine eliminates noise and vibration. Both long and short wave radio equipment are provided.

The interior of the cabin is covered with a balsa core and a ¼-inch aluminum sheeting which act as a sound muffler. Ventilation is secured by air brought in through the rear of the ship, circulated through the cabin and forced out at the front. Ample luggage space is provided in wing compartments.

The new four-place Stinson Cabin (Model R), also recently developed, is one of the most luxurious airplanes which have been built for the private owner. Balsa wood installation, upholstery in fine whipcord, satin finished hardware, arm rests, carpets, map and glove pockets, ash receivers and assist cords are only a few of its features.

Entrance to the cabin has been simplified by improved steps and a wide door. The front and rear seats are softly cushioned with automobile type springs to scientifically support the body at the most restful angle. The engine is mounted in rubber and an electric starter, together with spring shock absorbers, semi-air wheels, self-energizing brakes and the non-glare windshield, all help to make this the most complete of the new airplanes.

Stinson also produces the Stinson Model "S," priced at $4,595.00 and powered with a 215 h.p. Lycoming motor. There is a reduction of $500.00 from the price of last year. It is a sister ship of the Model "R" but does not contain all the new features of the latter.

A new Parasol plane by Heath will find a great many friends in the coming year. Selling at $1,074.00, it is one of the lowest priced and most popular ships in the light sport field. Powered with the Heath B-4 engine, it develops a high speed of seventy-five miles per hour, a cruising speed of sixty-five and a landing speed of thirty miles per hour. Fuselage and tail group construction are of welded steel tube.

This Fairchild cabin monoplane is a neat, roomy and fully equipped ship, intended for the private owner as will be seen. The range of vision is excellent.

Improvements have included better vision by placing a glass skylight over the pilot, more space is found in the cockpit and an air-scoop for powerplant cooling have all been incorporated in this new model. Heath will also present their "Knock-Down Kit," which now sells for $399.00 (a reduction of $100.00) and contains all the parts necessary for building a Parasol.

THE Taylor Cub monoplane is another of the two-place light sport models. It is powered with a Continental A-40 and develops a high speed of seventy-five miles per hour. Landing gear has been specially developed to withstand shock by fitting it with shock-rings of heavy rubber cores. The plane lists at $1,325.00. Seats in the cockpit are slightly staggered for comfort.

Alexander Aircraft Company has developed a new two-place cabin model "Flyabout" to sell at $1,465.00, equipped with a Szekely 45 h.p. engine. A compact heater for the cabin, side-by-side seating arrangement, sliding windows, and complete controllability will make it well known.

The new Ford Trimotor Club plane rears its head above them all. The interior of this costly liner—its ventilation and heating system—the long wave radio and desk combined—the lockers and fully cushioned, spring seats—the new height and width of the cabin—these, and other features, are enough to cause eye-blinking wonderment.

Bellanca is showing three models: The Pacemaker, the DeLuxe Skyrocket, and the Airbus. Improvements have been made in the former to increase payload and performance. The Pacemaker is powered with a Wright Whirlwind 300 h.p. and develops a speed of 141 miles per hour. Carrying six passengers, the interior has undergone several changes in newer type seats, better ventilation and increased vision.

The Skyrocket, shown as Bellanca's most recent development, is a six-place cabin job with room for 155 pounds of baggage, a high speed of 146 miles per hour, a service ceiling of 24,000 feet and contains the latest improvements in cabin interior, shock absorbers and air brakes. It is powered with a 450 h.p. Wasp. The Airbus, carrying six passengers, has undergone only cabin improvements and refinements. It is powered with a Wright "Cyclone", developing 575 h.p.

AMERICAN AIRWAYS is receiving a new Pilgrim transport job from the American Engine and Airplane Corporation. The pilot's cockpit and the mail compartments are, perhaps, the most interesting features of this plane which carries twelve passengers. From a standpoint of operating efficiency it will undoubtedly set a new standard.

Engine manufacturers have not been idle in searching for better performance and lower costs. Their efforts are being rivaled by those of instrument designers, aluminum and steel manufacturers, radio engineers.

END

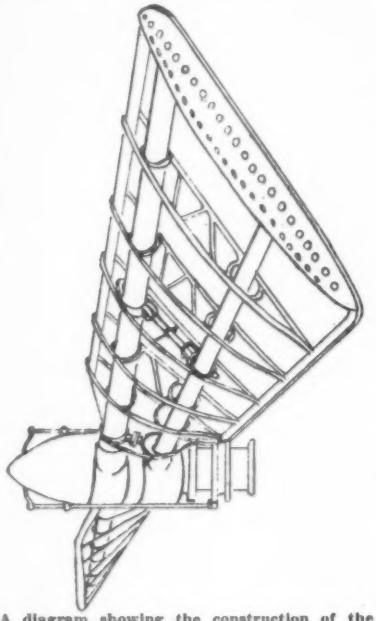
A Fairchild open cockpit ship shows excellent lines and is a sturdy reliable construction for the private owner or training school.

XUM

An Italian Variable Pitch Propeller

THE new automatic spacing variation airplane propeller, Benuzzi Patent, was exhibited for the first time at the Milan Fair, in the Aviation Pavilion.

Its inventor and builder, Benuzzi, has had to face, for its building, one of the most complicated and interesting problems of modern aerodynamics. He has been the first to find a practical solution of it. In fact, up to the present, the problem of the building a propeller able to maintain constant efficiency under any flight conditions, had been solved but partially by the building of "orientable blade propellers," while it can only be totally solved by the building of "bankable



A diagram showing the construction of the variable pitch propeller.

blade propellers," i.e., able, not only to change their own orientation with regard to the axle, but also, which is no less important, to modify their own spacing, uniformly and along their whole surface.

In a "bankable blade propeller", the changing of the inclination of the blades causes a uniform modification of the spacing along their whole surface, and this shall turn out equal everywhere; in an "orientable blade propeller," instead, this cannot be, owing to the stiffness of the blades, and, with the exception of the middle position, the spacing lengths shall be unequal. Benuzzi started there when dealing with this problem, and he solved it in this manner.

He could not build a massive propeller; he thought, then, of building one the blades of which could be modified all along their surface, and partly based himself, for this purpose, on the general structure of an airplane wing.

Moreover, he succeeded in determining automatically, according to flight conditions and needs, and by means of a special hub, the spacing changes.

The hub consists of a main body (fastened on one side to the engine shaft and bearing, on the other, to the contrivance regulating automatically the spacing variations) and of a ring encircling it at the rear. The regulating contrivance consists mainly of a strong spring, in an opposite casing, which serves to maintain the distance between the spars, allowing them to move, and of a special mechanism, which can be controlled by the pilot also during flight, and by which the initial tension of the springs can be modified and adapted to the various conditions of the engine. In this manner the propeller can automatically assume the spacing best suited to the different flight conditions.

This mechanism is located in the front part of the hub, and consists of a parallelogram of levers which can be

The completed propeller

conveniently regulated by means of a ring sliding axially over the notches of the back ones.

These consist of two high-grade steel tubular spars, the front one of which, rigidly set on the front part of the propeller hub, is of greater diameter and thickness than the back one.

Moreover, in order to allow of the shrinking of the blades, the tubing forming the spars is cone-shaped and of a decreasing diameter; its inner hole is cone-shaped too.

The two spars are connected, near the middle, by an articulated rod, which insures their harmonic movement, and maintains the distance between them.

A duralumin ribbing is placed on the spars. The ribbing is hinged on the front spar, with a special opening corresponding to the rear spar, in which the latter finds the necessary clearance. Duralumin sections unite the ribbing and serve as entering and trail edges for the blades. The propeller blades can thus be made to bank, without any modifications of the profile established for the blades in their various positions.

There is no need to discuss the importance of this problem and of its solution. Those devoted to the study of aerodynamics are familiar with it and its solution is worthy of appreciation, since it probably opens a wider field of action to builders, promising reliable and practical results.

A German Flivver Plane

A front view of the flivver, showing the wings folded.

THE Deutsche Luftfahrtverband has demonstrated this small plane. It was developed as the result of a contest for the cheapest practical plane that could be made with a fairly high speed.

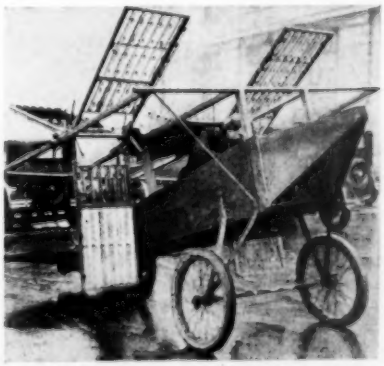
The top speed is about 125 kilometers per hour, or about 75 miles per hour. Although the attempt at speed obviously failed, the plane is very reliable and worth-while.

The illustration shows it with the wings folded before taking it into a small hanger, a feature that will be appreciated by the private owner.

What Is It? And If So—Why?

ACCORDING to a report that was recently received in this office, this is a new type of airplane that is expected to revolutionize the aviation field.

It has no wings and no propeller. In their place is a pair of paddle wheels that are reminiscent of the old Mississippi River boats. Their covering is of peculiar nature, something like a bird's wing. When a paddle is rising, the covering of the wing comes open, and causes no effect on the air. When the paddle is going down, the slots of the wing close, and produce a "lift" force.



The paddle-wheel type machine, recently exhibited at the Philadelphia Patent Exposition.

Modified Jenny Carries Pontoons

Here we have a "Jenny" all dressed up with pontoons and everything. Who would think that this was one of those "crates"?

WHEN Sheldon Simmons and Fred Soberg, of Juneau, Alaska, found a new "Jenny", never out of the crates, stored in an old building, and had examined the shiny new OX-5, and sat in the cockpit for long imaginary flights, they were smitten by a mighty urge to fly that same Jenny hither and yon over southeastern Alaska.

Forthwith they bent every effort to secure the money to buy the plane, hangar space, and flying lessons. A year later the plane reposed in a ground loop on its first flight. The wings were beyond repair, their money gone, and it looked like the old Jenny wouldn't fly after all.

Money, however, was a potent factor in all the plans. They took in another partner, Mr. Bergestand, pooled all their resources, and had enough to purchase a set of Alco wings, unmade-up wire for the rigging, and a pontoon and wing floats.

Simmons collected a library of aviation books, and in his spare time as power-house operator for the Alaska-Juneau Gold Mining Company, learned all about engines, angles of incidence, gaps, stagger, weight distribution, parasitic resistance, rigging, stress testing, etc., so successfully that a few months later the rebuilt plane stood complete, a home-made center section gracing her well known features.

Simmons handled the controls and Fred was ready to use his body weight to correct any serious fore-and-aft faulty distribution of weight. Everything had been checked and rechecked, tested and retested. It seemed that there couldn't be anything wrong but still—would she fly?

Well, she flew forty-five minutes on her first flight. Flying, there were only two inches of stick left to hold her nose down and the ceiling was only five hundred feet due to the float being too heavy—but still, she flew!

Not only then but many times last summer. They flew nearly every evening, with no accidents, and only a few minor changes in the positions of the floats and earned the high respect and interest of those who had hitherto derided their efforts.

Cierva Develops New Autogiro

JUAN DE LA CIERVA, inventor of Autogiro, is now in England experimenting with an offshoot of his machine. The new Cierva product has no fixed wing, and the object is to materially lessen drag.

Newspaper stories have called Cierva's new plane "wingless", but the term is incorrect. Cierva has gone back to fundamentals in developing this latest plane. Stability is maintained by supporting vanes on an articulated shaft. The vanes are wings just as much as a bird's pinions and feathers.

The mechanical difficulties discovered in the first successful autogiro resulted in the present compromise machine which has the conventional ailerons supported on a conventional wing, carrying tips with a pronounced dihedral. This wing contributes about 30 per cent. of the lift of the autogiro as it has appeared in the United States.

Cierva has great hopes for his "wingless", or non-rigidly winged machine. So far the ship flies well, but it is not fast, nor is its performance as satisfactory as the more modern autogiro built in this country by Pitcairn and in Great Britain by Cierva himself. But Cierva, by cutting down parasite and frontal resistance, hopes eventually to attain Schneider Trophy speed with his queer-looking plane.

Air Target Practice

by J. M. HAWLEY
(See Front Cover)

THE cover on this month's issue of POPULAR AVIATION shows target practice of the anti-aircraft branch of the field artillery force. During the last few years, the "Archie", as the anti-aircraft equipment is commonly termed, has been forced, by the advances in aviation, to improve their material and generally become more effective.

During the Great War, the anti-aircraft was of little use. Their actual value or efficiency was less than ten per cent, and possibly much less. When an enemy plane *was* brought down, it was in the nature of an accident; that is, unless that particular aviator was desirous of committing suicide.

Aviation went through a period of rapid development during the years that have followed the war, a period of great improvement. It was quite natural that the public at large got the impression that a strong air armada would be the deciding factor if another war should be declared—as will undoubtedly be the case. The anti-aircraft forces accomplished practically nothing during most of that time.

About four years ago, the artillery realized that their anti-aircraft equipment was back numbered. They had not been keeping up with developments. It was quite true that a strong enemy air force would be able to attack this country successfully.

Modernization of the anti-aircraft guns called for the solution of two major problems—mobility and accuracy. The former difficulty was eliminated with a tractor-truck and a trailer. Improved range finding instruments, combined with electrical control solved the problem of accuracy.

The mechanical improvements were completed in a short time, but it took many months of practice to develop the accuracy that is seen on the front cover.

The first indications of the progress became known last year. Briefly—the efficiency, or percentage of direct and effective hits had risen to better than fifty per cent. It is expected that the average number of bulls eyes will be sixty or more for each hundred shots fired this year.

And Speed! A modernized battery can move around the country as fast as forty-five miles an hour on hard roads and twenty or more miles an hour traveling cross-country. Compare that with eight to ten miles an hour when twelve horses were used.

It will be mighty uncomfortable for any enemy aircraft to invade this country. These new guns have a vertical range of 20,000 feet.

Twenty thousand feet is much higher than an airplane can effectively bomb or shoot up any ground structure, or any military formation.

(*Continued on page* 392)

XUM

The Steam Turbine Is Possible In Aviation

by JOHN D. RICHTER

How the Steam "windmill", now so extensively used in industrial plants, can be applied with profit to the airplane. Simplicity, economy and many other features are claimed for this prime mover.

IT IS ALWAYS interesting, and sometimes profitable, to speculate upon new types of aviation power plants, or at least upon plants that are somewhat different from those employed at the present time.

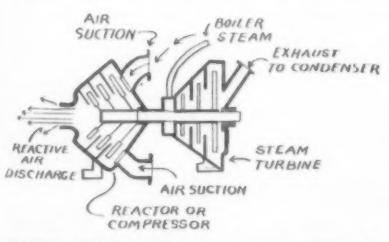
This does not necessarily imply brand new engines, based upon some revolutionary principle, but in the most part, simple readaptions of engines or motors that have proved their right to existence in other fields aside from aviation. Practically every form of motive power or prime mover is a possibility, perhaps with the exception of water-wheels, hence it is well to muse over the different classes of heat engines available before deciding that any one type is the best.

In view of the many admitted shortcomings of the present day internal combustion engine, which has always contributed to the hazards of flight because of its uncertainties, it is well to anticipate improvements along other lines although at first glance they may seem to be dreams to the layman. The gasoline engine is a heritage handed down from automobile development and holds its present overwhelming popularity by reason of standardized thought and practice.

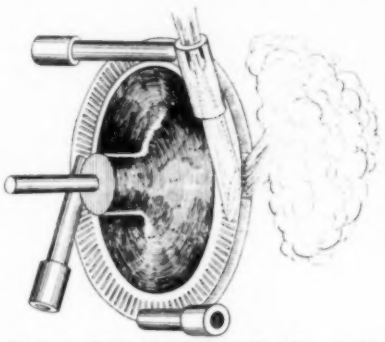
These preferences are largely commercial, and the result of judicious propaganda harking back to the early days of the automobile. Thousands of patents have been granted upon improvements and alleged improvements applied to the internal combustion engine, while a very few inventors have gone into other domains to find subjects for their brain storms.

However, during the past two or three years, several independent engineers and inventors have been investigating the possibility of the reciprocating steam engine for the propulsion of airplanes, and many new ideas have been opened up that promise success in this direction. Several reciprocating steam engine plants have already been built on an experimental basis that have shown excellent results.

Burner and boiler troubles, formerly



Section through the air blower which is direct-connected to the steam turbine at the right.



Here we have the basic principles of the turbine clearly illustrated. Steam is directed by nozzles on the bladed rotor.

the source of much difficulty with steam plants, have now been overcome to a great extent, so that the future of the steam plant seems to be technically a factor in aviation, although it may meet with considerable commercial opposition as did the steam car in years gone past.

NOW, the steam turbine is only a few steps away from the reciprocating steam engine. It has been highly successful in both stationary power plants and in marine service—in fact it has largely displaced the reciprocating steam engine in these fields. Further, the steam turbine possesses many inherent qualities that make it particularly adapted to airplane propulsion. Qualities that are outstanding advantages in marine service, and let it be known, marine propulsion is more nearly analogous to airplane propulsion than to the driving of automobiles or tractors.

Like the motorboat or transatlantic liner, the airplane imposes a practically constant load at practically a constant speed and this is the special province of the steam turbine. On the other hand, steam turbines do not thrive where the speed or load are varied between wide limits or where reversal of motion is desired.

Now let us examine the elementary steam turbine in its new role. We find it, to begin with, exceedingly simple mechanically. It consists of a few simple bladed rotating discs mounted on a single shaft. This constitutes the moving element. Around the revolving discs, or "rotors," is a casing containing various stationary nozzles or bladed partitions. And this is all there is to a device that will operate successfully through a range of 1,500 to 40,000 revolutions per minute!

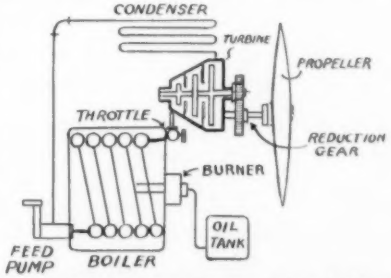
There are no reciprocating parts of any sort to cause wear and vibration, nor is lubrication a difficult problem with a machine having only two plain bearings. Compare this with a modern eight-cylinder gasoline engine with its multitudes of valves, tappets, cylinders, pistons, connecting rods and other reciprocating parts, all calling for continual adjustment and care.

First, last and always, mechanical simplicity stands for reliability and freedom from trouble, and in this respect the steam turbine is the ideal machine. Outside of the turbine proper, are two constantly meshed herringbone speed reduction gears for reducing the high speed of the turbine to the lower propeller speed. Such gears have been perfected to the point where they are thoroughly practicable for transmitting almost any amount of power at any speed within the range of the turbine.

From 10,000 r.p.m. at the turbine shaft to 1,200-1,500 r.p.m. at the propeller is a practical ratio. Still better, is a "squirrel cage" reactor or blower of small diameter, direct connected to the turbine shaft. This small diameter reactor, built on the multivane principle, is highly efficient and can run at turbine speed.

WITH any steam power aviation plant, it is necessary to equal or exceed a pressure of 600 pounds per square inch, and also to superheat this steam before it passes to the engine or turbine. The total result is a very high temperature fluid which can be more easily handled in a turbine than in a reciprocating engine with rubbing pistons and valves. In the case of the turbine, the steam does not come into contact with lubricated surfaces, and this is of great importance in the operation of machinery at high temperature.

Pistons and slide valves must receive lubricants in a high order of efficiency, but the steam turbine requires only a common bearing lubricant that is recirculated with very little loss. Again, since the lubricating



Schematic flow diagram of a steam turbine and its auxiliaries.

oil does not contact with the steam, the condenser and boiler tubes will be free from oil films and this means a more efficient heat transmitting surface than is ordinarily possible with a reciprocating engine plant where some of the cylinder oil is always being returned to the boiler and condenser.

Oil in the water or steam is a more serious matter than would be apparent at first thought, and while adequate oil separators can be applied to the reciprocating engine exhaust, yet the steam turbine makes such appliances unnecessary for the very reason that there is no oil in the beginning. Again, the absence of oil in contact with the steam makes it possible to carry pressures and superheat temperatures above those possible with reciprocating engines.

The steam turbine, like the steam engine, operates on a closed system. That is, the water and the steam are confined within a tight circuit so that the weight of the heat conveying liquid is constant. Steam generated in the boiler passes to the turbine, the exhaust from the turbine goes to the condenser where the steam is reduced to water, and this water in turn passes back to the boiler, from which it is again re-circulated.

Being out of contact with the atmosphere, the operation is independent of atmospheric conditions. There is no noise from the exhaust of the engine or turbine, nor is there any loss of water. This is a very great advantage as no "make-up" water is necessary. Possibly a few quarts of water, not much in excess of the water required for the radiator of a gasoline engine, would be all the water necessary for the operation of a closed circuit steam plant.

One of the great virtues of a steam turbine is its compactness. A turbine of the high pressure, high speed type occupies about one-third the volume occupied by a gasoline engine of equal output. Further, the outlines of the turbine are such that it is easy to streamline it in case that the turbine is presented to the windstream.

Its weight, of course, is correspondingly less than that of other prime movers, the weight being so small that it more than compensates for the additional weight of the boiler and condenser. The steam turbine shaft weighs about one-fortieth of the weight of an eight-cylinder "Vee" type crankshaft having the same strength. The outside casing of the steam turbine weighs about one-fifth the weight of the lower half of the gasoline engine crankcase, and so on, through almost numberless items.

THE only possible objection to the steam turbine, as applied to aircraft, is the question of gyrostatic couples at high rotative speeds. It will be necessary to apply a high degree of rigidity to the turbine structure for resisting the gyrostatic stresses induced by suddenly maneuvering the ship.

It should be noted that this gyrostatic couple increases with both the speed and the diameter of the rotating mass, and in such a way that it acts at right angles to the plane of rotation. Thus, when the ship is ruddered to the right, the gyro action tends to nose the ship down. When the ship is nosed down, the gyro action tends to turn it toward the right. And so on.

However, this might be a reason for the employment of small twin turbines in which the rotors revolve in opposite directions, the gyrostatic couple of one rotor neutralizing that of the twin rotor revolving in the opposite direction. At the same time, the employment of twin turbines would further simplify the application of reduction gearing where such gearing is deemed necessary with a slowly revolving propeller of the present type.

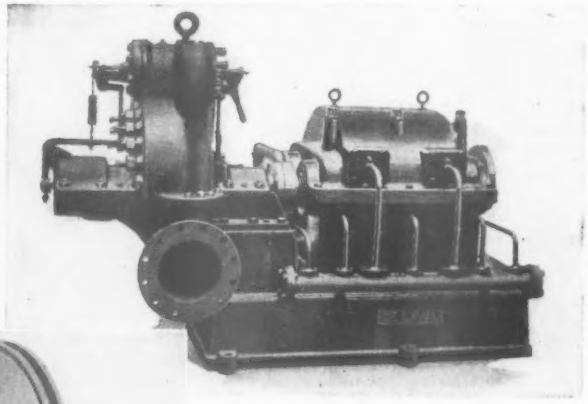
However, from preliminary calculations and estimates made upon a single rotor of 12 inches diameter and

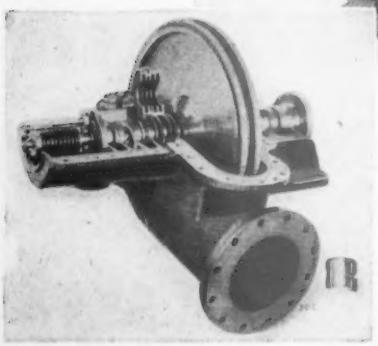
(*Continued on page* 392)

At the right is a stationary De Laval steam turbine direct-connected to an electric generator, a combination that is highly efficient.

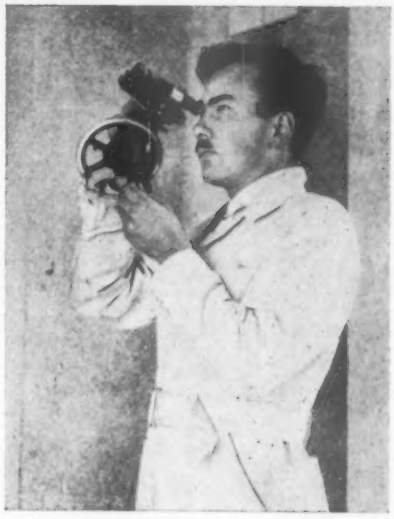
+ + +

Below, the top casing of the steam turbine is removed so as to show the bladed rotor and the bearings. This is a De Laval single stage turbine.





New Avigation Instrument



Showing how the new avigation instrument is used for solving problems.

ONE of the recent important contributions to the science of avigation is the Spherant. This was invented and perfected by Mr. Howard B. Kaster, in charge of Avigation and Meteorology at the Boeing School of Aeronautics.

The Spherant has been accepted by the Bureau of Aeronautics of the U. S. Navy Department and is given considerable space in the training manual of the U. S. Naval Aviation Training Station at Pensacola, Florida.

In spite of the fact that improved instruments and tables have done much to simplify the work of avigation, celestial avigation will always require the solution of the spherical triangle. This has formerly been worked out mathematically with the aid of computation tables or mechanical calculating devices, and a long period of technical training in mathematics and astronomy, as well as much practical experience, was necessary for proficiency as a navigator.

The Spherant makes possible the solution of the spherical triangle mechanically, just as the better known slide-rule solves problems in multiplication or division mechanically. This does away with the long period of technical training formerly required and minimizes the possibilities of error. The Spherant gives the desired quantities directly and no complicated tables, except the Nautical Almanac, are necessary.

The Spherant is said by an officer of the Naval Academy to be "the most revolutionary and progressive idea to be developed since Captain Sumner laid down the first line of position in 1837."

Mr. Kaster, in his development of the Spherant, has done considerable work with the navigating and air officers of the United States Navy, both with the battle fleet and at the Naval Air Station at San Diego.

The Sensational Comeback of Jerry Donahue

by DICK HAM

This true story, stranger than fiction, tells the story of Jerry — a victim of the mental disease known as "Amnesia." The facts, as set forth, have been verified by investigation.

DESPERATELY I grabbed for the stick, Too late! We hit the ground like a bullet, but the angle was not quite steep enough to bury the ship or nose it over. The landing gear struck the field a wallop that seemed to drive my knees through my chin and shove the chin through the top of my head.

Then we *bounced*—and somehow I caught things on the first bounce. Frantically I yanked her and leveled off while we took another bounce—a little straighter this time—then another and still another. After a year of wild buck-jumping and flopping seven ways from the middle, I brought the plane to a shuddering stop.

It was a wide-eyed Jerry Donohue who climbed out to meet my anger. He seemed wholly ignorant of his insane blundering.

"W-w-what happened, Mr. Drake?" he stammered. "Did you have trouble sitting her down?"

"Why, you so-and-so," I roared, "you almost killed us both! Why in thus-and-such didn't you level her off?"

The reply left me speechless. Said Jerry:

"*I?* Why, *I* didn't touch anything!"

When I recovered sufficiently to ask questions, I learned that my pupil had been leaning out of the cockpit, looking at the landscape and had never seen my arm signal at all.

Sightseeing was just one of Jerry's bad habits. He had them all. He was air-minded, all right, but in his case the term meant light-headed as well. I was last of the eight pilots at the Oldham Airport who attempted to teach him flying. Each of the others had given him up for a bad job after some such experience as mine.

He nearly killed Skeet Norcross and himself one day by pulling back the throttle so he could be heard above the roar of the engine. Jerry never noticed how close they were to the ground. Skeet managed to straighten out the ship just as it gazed the tops of the buttercups.

IT WAS too bad. With all his soul, Jerry yearned to be a pilot. He had courage and that rare "feel" of the air that makes great flyers, but not a grain of common sense. He was sort of a mystery, too, appearing from nowhere and simply hanging around the airport until we finally accepted him as a combination of handy-man and clown.

Red-headed, freckled, under average height, he looked to be about twenty-five years old. He told us he did not know his own age and could not remember his parents. Somehow he must have picked up a fair education, judging from his speech and writing.

"A-a-ah! A quivering sigh swept through the throng."

Shortly after my harrowing experience with the youngster, we announced what we believed would be a sure-fire attraction at the Oldham Airport. We were bringing Jimmy Young from the West Coast to do one of the long free-falls for which he was celebrated. He was billed as the world's foremost parachute jumper—which, as a matter of fact, I guess he *was* at that time.

The jump he was to make for us involved dropping about four thousand feet before pulling the rip-cord of his chute, leaving a matter of two thousand feet or so as his margin of safety.

Our advertising was effective, the day was clear and we drew the biggest crowd in the history of the field. Everything was lovely except that Jimmy Young failed to appear. We were frantic. The show was scheduled to begin at two-thirty in the afternoon and the jump was to take place at three o'clock.

We stalled as long as possible. None of us took to the air until well past the scheduled hour. Then we took off, one by one, and each did all the tricks at his command. We gave the crowd some spectacular stuff on our own hook, winding up with some first-class formation flying after which we came down together and gathered at the center of the field in an anxious huddle. It was almost half past three—and still no Jimmy!

"I guess you'll have to tell the crowd there won't be any jump," said Norcross to me.

It looked that way. Of course, one of us might have tried the stunt, but the people probably would have noticed the substitution. Besides, although every one of us had bailed out from necessity, we were not exactly eager to attempt so long a free-fall.

I PICKED up a megaphone to make the announcement, but before I could begin, a queer figure came striding toward us from the field office. It was Jerry Donohue clad in togs that were too big in every direction. The fool kid had sized up the situation and decided to save the day. He had always wanted to make a parachute jump, he said, and if we would just tell him what to do.

If we had not been in such a jam and in such a hurry, I suppose we would never have accepetd Jerry's offer—but we did. With deep misgivings, I announced Jerry Donohue, as Jimmy Young, world's greatest parachute jumper.

We bundled Jerry into Skeet Norcross's cabin job. It was a mean crock to climb out of, but we had selected it for Jimmy's jump because of some acrobatics he usually performed to give the crowd extra thrills. We had removed the cabin door to make things easier.

Donohue, like the rest of us, was wearing one of the seat type standard service packs—hardly the 'chute Jimmy Young would use for a jump of this kind, but dependable enough.

"Jerry," I said, "there are only two things for you to remember. One of them is to jump clear. Give a good healthy leap and don't hesitate at the last moment. The other is not to pull your rip-cord till you have dropped about half-way—*but for Pete's sake don't wait too long!*"

Knowing Jerry, I had a last inspiration. I fastened the rip-cord to his right right wrist.

"There, you bonehead," I said, "maybe this will spoil the jump, but *somewhere* along the line your 'chute will be sure to open!"

Norcross was making gestures. We had enough altitude.

"Here you go, Jerry!" I exclaimed. "Careful getting out. Be sure to jump as far as you can."

The youngster was already clambering out of the cabin.

I suppose what happened was no more than we might have expected, but Jerry Donohue certainly made the most unconventional free-fall on record.

HE STARTED by stumbling in the door. There was no question of a leap; he *fell*,—head foremost! I was too scared and sick to see anything af-

ter that. Norcross and I started down immediately to pick up the pieces of a fellow we really liked, for all his stupidity.

For more than a thousand feet Jerry remained upside down. Then, as his momentum increased, his position shifted until his body was horizontal, face downward. The crowd was horror-stricken. Would he *never* pull the rip-cord? Three thousand—four thousand—five thousand. Still he hurtled through the air toward certain death.

A-a-a-h! A quivering sigh swept through the throng. At last the great dome of silk emerged from Jerry's pack and checked him with a terrific jerk. The shock flung him upright. He swayed like a giant pendulum, then steadied. But still the rate of his descent was tremendous. He had pulled the cord too late. Death seemed inevitable.

Not for Jerry Donohue! He smacked into a big nest of telephone wires. It was *some* smack! The wires sagged as though plucked by a giant hand, then lifted—and there were Jerry and his 'chute, all tangled up in the prettiest mess imaginable.

THE next we knew, Jerry was hanging by his toes to a couple of wires. Then he tumbled some twenty feet into a ditch, landing on his head. Apparently he was unhurt. The jump had been a huge success and the crowd lionized him.

"Why the devil," I demanded, when we had hustled him into the field house, "didn't you jerk the cord quicker?"

Jerry grinned sheepishly.

"Well," he replied, "it was funny to see things comin' up at me, gettin' bigger and bigger. I guess I just forgot I was fallin'."

"But werent you scared when you finally *did* pull it?"

Another sheepish grin.

"No, I wasn't, Mr. Drake. You see, I never pulled it."

I blessed the impulse that had prompted me to fasten the cord to his wrist.

Passengers were now clamoring to be taken up. We pilots hurried to the line and began taking in money as fast as we could handle the traffic. It was just after I had made a landing that Jerry's next exploit began. Something swooped around one of my wings like a wounded eagle, and through the dust I made out our newest ship and pride. It was Jerry, taking up a lovesick lad and lassie who were now destined to be sick from something besides love.

For a starter, he took off cross-wind with one wing-tip trailing in the dust like a bird with a broken pinion. Then he made a flat turn into the wind that would have marked the end for anybody except Jerry. Nothing daunted, he poured out the fog to all the three hundred horses, hung his ship on the prop and then went heavenward almost vertically.

The novel zoom ended in a stall at

(*Continued on page* 394)

A Topographical Model For Landing Instruction

With the model field before them, the students learn how to enter the field under different conditions.

PICKING a landing place in difficult country and with contrary winds is a problem that cannot always be taught advantageously from books. Neither can it be learned from the ship in flight so that all of its phases can be thoroughly understood.

Therefore, a flying school has prepared a topographical model for the use of the students as shown by the accompanying photograph. This is so arranged that it contains most of the problems to be encountered in making actual landings.

The Photo Fans' Club Recruits New Members

THE club is developing quite rapidly Some more very interesting letters have been received. It is too bad that there is not room in this column to print them.

Again we are having difficulty in reading the names and addresses. If a name is not found in the list, that is the trouble.

Here are the names of the new members:

Perry Edmondson, 795 N. San Antonio Ave., Pomona, Calif., wants to trade or buy pictures of war time planes in action or stationary. He promises to give quick action.

R. L. Hill, 10 Cedar St., Glen Rock, L. I., wants all kinds of pictures.

Harold M. Kahl, 531 E. Magine St., Bellflower, Calif., wants to swap parachute pictures. Will buy or sell if the price is reasonable. He is a 'chute jumper himself.

Charles Donald, 1098 5th Ave., Woodcliff, N. J., wants war photos. Wants to swap a hunting knife and some 45 caliber shells for the photos.

Oliver R. Phillips, 1043 Cloverdale St., Seattle, Wash., is willing to buy or trade. He wants, in addition to the photographs, specification and performance details. He desires nothing smaller than 2¼x3¼ inches and nothing larger than 4x5 inches.

Charles A. Raybon, 13307 Garden Rd., East Cleveland, Ohio, has many 2¼x4¼-inch photos. They were taken around Kelly Field at the close of the war, and at the Cleveland Air Races of 1929 and '31. There are some more from the Chicago Air Races of 1930. He is interested in war scenes and foreign planes. Pictures of noted fliers are welcome. He will do business on a swap basis.

Jack Edwards, 99 McCook Ave., Carrollton, Ohio, wants to swap newspaper and magazine clippings.

Tony Zadnik, 9801 Prince St., Cleveland, Ohio, wants to trade pictures of war planes. He has quite a few pictures.

Arthur L. Whitmer, 1434 28th Ave., Oakland, Calif., will sell or trade all kinds of war plane photos. He has various photos of famous aces, and some actual combat pictures.

And that is all for this month. It is hoped that this department will continue to grow. Remember, all that is necessary is to send in your name and address. Publication will be made as soon as possible.

XUM

Details of the Siemens & Halske Single-Seater

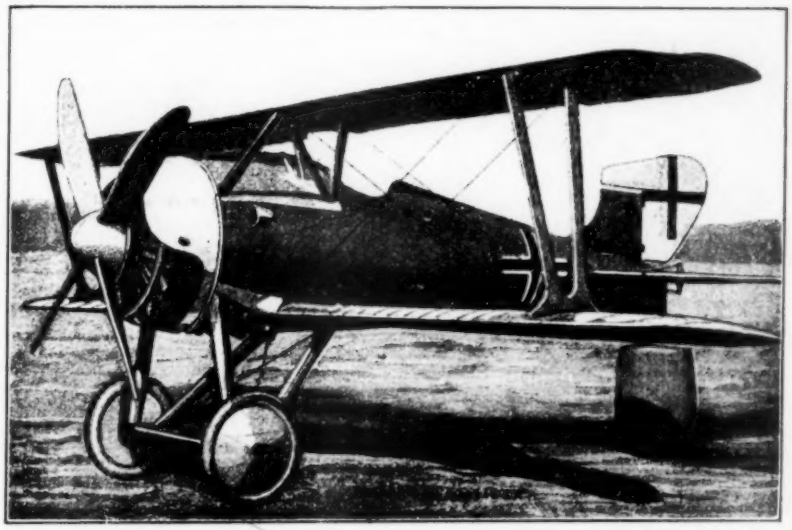
by J. B. RATHBUN

Scale drawings and full detailed description of a unique German single-seater that was introduced at the end of the war.

THERE were a lot of German machines brought out near the end of the war that have received very little notice in the aeronautical press, largely for the reason that they were too late to participate to any extent in the fracas.

Among these machines, which have remained more or less in oblivion, is the Siemens & Haske Einstizer, Type D-IV, a single-seater combat plane that awakened quite a little curiosity at the time. In plan and elevation it greatly resembled the Spads, but at this point the resemblance ceased for it was equipped with a Siemens-Schuckert air-cooled rotary engine which drove a four-bladed propeller in a very peculiar manner. It was a biplane with the upper wing nearly in contact with the top of the fuselage and equipped with "V" type interplane struts near the wing tips.

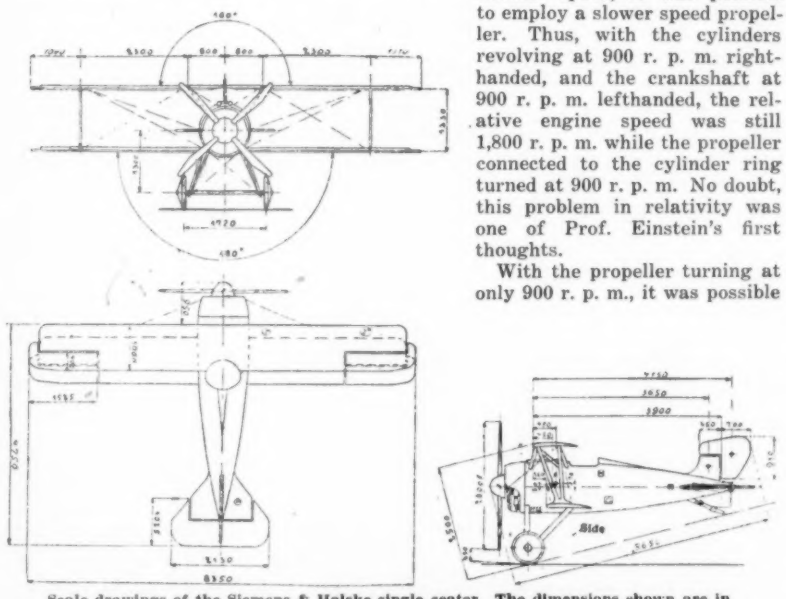
This single-seat fighter, or "Einsitzer", had a short chunky fuselage built of plywood. The stabilizer and fins sprouted out of this construction in such a way that external bracing was unnecessary. The cowl, covering the rotary cylinder engine was not unlike the present cowl rings designed for radial engines, except that the bottom of the ring is cut away. A steel tube landing gear with sheet aluminum fairings gave relatively little resistance, for the reason that the landing gear struts are much shorter than common with German machine, all of which brings us to the peculiarities of the power-plant and propeller.



Here we have the Siemens & Halske single-seater with its four bladed propeller and its peculiar double action geared engine. It greatly resembles an Albatross.

In the first place, the 11-cylinder Siemens-Schuckert 200 h. p. rotary cylinder engine was of unusual design. Both the cylinders and the crankshaft revolved — in opposite directions — which was different from the practice of the Gnome and LaRhone in which only the cylinders revolved. By allowing both members to revolve at half normal speed, it was possible to employ a slower speed propeller. Thus, with the cylinders revolving at 900 r. p. m. right-handed, and the crankshaft at 900 r. p. m. lefthanded, the relative engine speed was still 1,800 r. p. m. while the propeller connected to the cylinder ring turned at 900 r. p. m. No doubt, this problem in relativity was one of Prof. Einstein's first thoughts.

With the propeller turning at only 900 r. p. m., it was possible to attain higher efficiency and greater thrust, the centripetal force and stress on the blades is greatly reduced and the gyro-static couples are likewise reduced toward a minimum. Again, the air-resistance of the revolving cylinders was reduced, there was less oil loss and numerous other advantages.



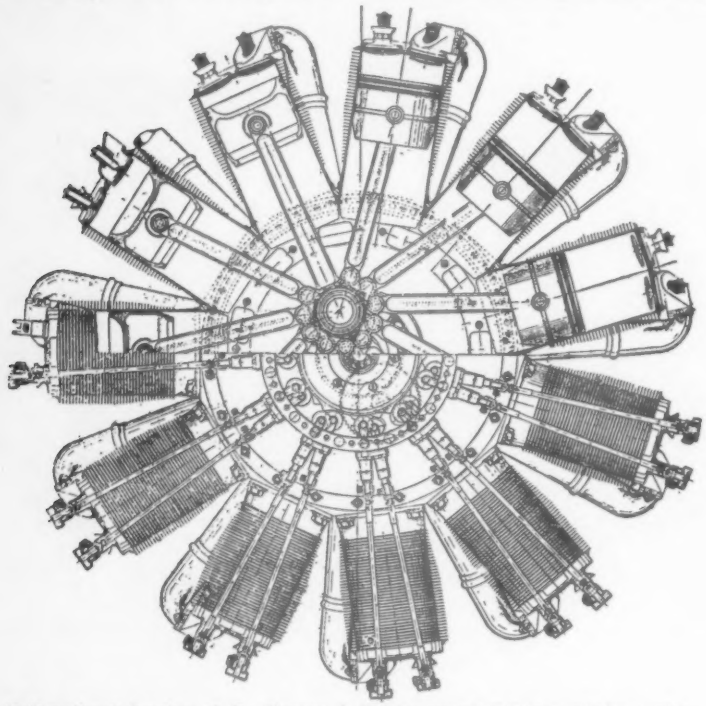
Scale drawings of the Siemens & Halske single seater. The dimensions shown are in millimeters. 25.4 millimeters equal one inch.

The low speed called for either a very large two-blade or a very small diameter four-blade propeller to absorb the engine power. The final choice was made in favor of the four-blade type, which is less efficient than the two blade, but which permits of a shorter landing gear structure and less resistance from this source. As a result of these radical alterations in design, the machine was very maneuverable, had a good horizontal speed and an exceptionally great climbing rate. Graphs compiled from tests show that it climbed 7,800 feet in the first three minutes or 26,000 feet in 12 minutes.

This ship was equipped with two rigid synchronized machine guns firing through the propeller. Very severe tests, made at Adlershof, showed that the structure was unusually sturdy, being able to withstand power dives, power spins and upside-down flights without the slightest indication of danger. The empty weight was 1,155 pounds with a power loading of about 5.25 pounds per horsepower.

A considerable amount of stagger is given the wings while the span of the lower wing is somewhat greater than that of the top wing. There is no di-

hedral nor sweepback. Both the elevator and the vertical rudder are hinged in the usual manner, and it will be noted that there is a fixed vertical fin both above and below the fuselage. One interesting point is the fact that the vertical fin is cambered only on one side to compensate for the torque of the engine. The top wing is in one piece connected to short stout cabane struts.



Half-sectional drawing of the Siemens & Halske geared rotating cylinder engine.

SPECIFICATIONS

Span (lower wing) .....27 ft., 7 in.
Span (upper wing).....26 ft., 0 in.
Chord .....3 ft., 3 in.
Wing area .....176 sq. ft.

* * *

Length .....18 ft., 6 in.
Height ..... 8 ft., 2 in.

* * *

Weight, empty .....1155 lbs.
Weight, loaded .....1515 lbs.

* * *

Power loading (empty).5.25 lbs./sq.ft.
Power loading (loaded).7.58 lbs./sq.ft.

The usual type of wood box spar is employed in the wings, the spar being in halves, parted vertically, and hollowed out inside before the halves are fastened together. At the point where struts and other connections attach to the spars, that part is left solid. The internal bracing of the wings comprises a system of steel-tube compression members and steel wire tension stays while the wing fabric is sewn to the ribs.

As in the case of the Nieuport, the ailerons are operated by steel tubes and bell-cranks, the ailerons being hinged to the rear spar, and as will be seen, are of the balanced flap type. They are four in number and are used on both upper and lower wings.

An interesting detail is the "A" or "V" type interplane brace, which is of wood, of streamline section and is hollowed out for lightness. The lower or pointed end of the "V" is carried on a bridge beam running between the front and rear spars, and thus allows a certain degree of flexibility to the wing tips which is claimed to be of advantage when taken into combination with the action of the ailerons. As an extra safety provision against a long steep dive, external drag-bracing wires run from the nose of the fuselage to a point on the spars.

The four-bladed propeller is built up with the wood laminations all in one plane and its estimated efficiency is 68 per cent. Owing to its low rotative speed and the high translational speed of the ship, the pitch is relatively high—3.9 meters or about 12 feet. The diameter is about 9 feet. Thus, the propeller tip velocity is quite low with a corresponding reduction in blade stresses, and gyrostatic effect, at a rotative speed of 900 r. p. m.

A very interesting fuselage construction was adopted, the framework consisting of a series of transverse formers or bulkheads carrying four pine longerons. The outer three-ply veneer is then tacked to this assembly so that it is evident that the stressed skin of the plywood is effective in carrying a large percentage of the bending stresses. To assist in the resistance of the bending stresses, and to take up the horizontal shearing forces, diagonal formers are run from the bulkhead.

END

Commercial Licenses Issued to Home Builders

FOR THE first time since commercial licenses were issued for airplanes, it is now possible for novices who build their planes at home to obtain NC licenses for their home-assembled ships and fly with federal approval.

This is expected to add considerable stimulus to the American aviation industry because it permits the person who has much flying zeal but little money to own and fly his own plane.

As is well known in the industry, the Department of Commerce, some six years ago, ruled that no airplane could operate in interstate traffic for pay unless the plane carried an NC license. This meant that design, material and workmanship must be rigidly inspected and approved by Department of Commerce representatives.

Since then a considerable number of states have passed laws prohibiting flying of any sort unless planes bear federal licenses. This automatically grounded scores of capable pilots who had been using planes built by themselves from parts obtained from various factories, because none of the manufacturers of such home-assembly kits had met Department of Commerce requirements.

Many of the pilots thus affected have flown only at infrequent intervals since, after all an airplane is not the easiest thing in the world to borrow.

Legislation not only grounded these men and women, but it served to dampen the enthusiasm of countless young people who had been bitten by the aviation bug, yet were unable to finance the purchase of factory-built airplanes. Most of them, however, have the few hundred dollars necessary to buy parts and materials and assemble planes in home workshops.

How to overcome this handicap has been a problem confronting the industry for some time. It stood to reason that if a plane, built in an established factory, could qualify for an NC license, certainly all parts and materials used in this ship, together with the design, would carry federal approval.

The question was taken up with Clarence M. Young, assistant secretary of commerce for aeronautics. It was pointed out that certain factory-built models had qualified for an NC license and hence design and materials had government approval, leaving only the matter of workmanship to be passed on in case a person desired to buy the parts and assemble his own ship.

As a result of several conferences, a decision was made by the Department of Commerce that these home-built planes were eligible for NC licenses provided the approved kit of parts was used. To insure qualification on workmanship, the Department of Commerce will inspect both before and after covering.

Answers to Official Mechanic's Exam

Answers to the sample questions issued by the Department of Commerce, Aeronautics Branch, for the examinations leading to a mechanic's license.

PART II

EDITOR'S NOTE. These questions were answered by the technical staff of POPULAR AVIATION in response to a demand from our readers.

Q. Why does water in gasoline affect the proper running of the engine?

A. Because it obstructs or cuts down flow of gasoline and may freeze and block lines in cold weather.

Q. What are the most important things to inspect on an engine prior to flight?

A. Check hold down bolts of engine and prop, supply of gas, oil, and water, check ignition and lubrication, and carburating system, check r.p.m. and sound of engine.

Q. Describe the function of a carburetor.

A. The carburetor sprays the gasoline into a fine mist and then mixes spray with the proper amount of air to burn it.

Q. How would you adjust a carburetor if the engine was idling too fast?

A. Turn back idling screw—leaner mixture.

Q. Give the approximate position in degrees of the crankshaft at the time the intake valve opens and when it closes on an airplane engine.

A. Intake valve opens 15° after top center and closes 48° after bottom center in the average engine.

Q. Explain the purpose of a condenser in an ignition unit.

A. Reduces the spark at breaker contacts, reduces contact point burning and improves spark at plug.

Q. Why is airplane engine oil of much heavier body than automobile engine oil?

A. Because the temperature and compression pressure are higher in the case of the airplane engine.

Q. After how many hours' flying should the following be checked:

(a) Breaker points in magneto?

A. Daily.

(b) Spark plug gaps?

A. 15 hours.

(c) Engine bed bolts and nuts?

A. 15 hours.

(d) Valve clearances?

A. Daily.

(e) Gas strainers?

A. Daily.

(f) Oil strainers?

A. 15 hours.

(g) Hose connections (oil and gas)?

A. Daily.

Q. Name four reasons for valve failure.

A. Warped valves, broken spring, stuck in guides or burned seats.

Q. How would you locate a bad spark plug with the engine running?

A. Short circuit the plug with screw driver. If the engine slows down, the plug is O.K. If the speed does not change, then the plug is defective.

Tuning-up the engine on a licensed ship requires a licensed airman. Can you qualify for the job after looking through these questions and answers?

Q. Give seven definite reasons for an engine failing to develop power.

A. Poor mixture, too cold, leaking valves, defective spark plugs, spark retarded too far, improper tappet clearance adjustment, incorrect breaker point adjustment.

Q. Give several reasons why an engine might be hard to start and how you would remedy each case.

A. Ignition retarded too far (advance spark), dirty spark plugs (clean and readajust gap), incorrect tappet clearance (readajust), gasoline strainer clogged (remove and clean), weak spark (test and remedy), throttle open too far or not enough (readajust), air leak in intake manifold (renew gaskets).

Q. How many times does a crankshaft revolve on an OX5 engine before all cylinders fire?

A. Twice.

Q. Give the firing order of two aviation engines.

A. Hispano-Suiza: Right (4-3-1-2) Left (1-2-4-3). Nine cylinder radial (1-3-5-7-9-2-4-6-8).

Q. What results from breaker points being too close? Too wide?

A. When too close, points burn. When too far apart, coil does not have time to build up and the points hammer too hard.

Q. Explain why clearance is necessary between valve stems and rocker arms.

A. To allow for expansion of valve stems when they become heated.

Q. How do you determine whether the valves on an aviation engine need grinding?

A. Compression weak when engine is turned over. May pop back in carburetor, even with rich mixture. Loss of power and engine runs unevenly.

Q. Why are all fuel lines annealed before their installation?

A. So that they will not crack while being bent and so that they will not crystallize with vibration after installation.

Q. What is the purpose of the safety gap in a magneto?

A. To relieve excess voltage when secondary circuit is open. Protects insulation against puncturing.

Q. What is the speed ratio between camshaft and crankshaft on an engine with which you are familiar?

A. One to two. The camshaft runs at half crank-shaft speed.

Q. How is a condenser tested?

A. By opening breaker with fingers. If the spark is unusually bright and snappy, the condenser is defective. Applying 110 volts with lamp across condenser will indicate a shorted condenser if the lamp lights up.

Q. How do you determine proper clearance when fitting new piston rings?

A. Generally specified by engine builder. Side play from .0015" to .002" at top of piston. From .004" to .006" at bottom. They should neither bind nor shake when the piston heats up.

Q. How can you determine when the float level is too high in a carburetor?

A. Floods and overflows when engine is standing still. Mixture is too rich and is not affected by idling adjustments.

Q. What is the function of a scavenger pump in an aircraft engine?

A. Removes oil from crankcase as fast as it falls from bearings and thus keeps sump dry.

Q. If the firing order is not known, how would you determine it?

A. Watch the order in which the inlet valves open when the engine is turned over by hand. The valves open in firing order.

Q. Give eight causes of ignition trouble.

A. Fouled spark plugs. (2) Spark plug points too widely separated. (3) Loose or disconnected wires. (4) Oil

(Continued on page 389)

Question and Answer Department

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION'S Technical Staff.

WE HAVE had a great many questions submitted to us this month, part of which are answered in this department and the remainder will be found in the Mechanic's Exam Questions in another part of this issue. They are not included here for obvious reasons.

We wish to remind you that this department is open to all of our readers and we heartily solicit your inquiries so long as they are within the scope of this department. Address your inquiries to Question and Answer Department, POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill.

* * *

QUESTION:—Frank F. Hartman, Janesville, Wis. *What limits the power of an airplane to climb, that is, what prevents one plane from climbing up at a steep angle while another ship will climb at a lower rate? Is this really due to the airplane or is it due to differences in the engines?*

ANSWER:—THE climbing ability is primarily due to the excess of power remaining after the power for horizontal flight is deducted from the available engine power. Thus, if we have an engine that actually delivers 100 h.p. to the airstream, and if it only takes 55 h.p. to propel the plane horizontally at that speed, then we will have: $100 - 55 = 45$ h.p. remaining for climbing the ship.

If it takes 35 h.p. to propel another ship with the same size of engine, then we will have: $100 - 35 = 65$ h.p. for lifting the ship, and therefore this ship will climb faster than the first example, all other things being anywhere near equal. It is obvious that the same ship will have different rates of climb at various speeds, the greatest rate of climb being had at the most efficient speed of the plane. There is one forward speed, and only one, at which the ship will give the maximum rate of climb.

* * *

QUESTION:—Karl Ames, Chicago, Ill. *What is meant by the expressions, "slip" and "slip-stream"? How does the propeller slip and can this be avoided?*

ANSWER:—WHEN we turn a steel screw in its nut, the screw advances a distance equal to the "pitch" of the screw, or the distance between the threads, in one revolution. Now, the propeller is also a form of screw or "helix", which if revolved in a solid nut would also advance a distance equal to its pitch in one revolution. The angle of the propeller blades corresponds to the angle of the screw threads on the screw.

However, the airplane propeller does not work in solid material, but in the yielding substance known as "air". It does not advance a distance equal to the blade pitch, but this distance is considerably less due to the "giving" or yielding of the air behind the blades. The difference lost, or the difference between the blade pitch and the actual advance in one revolution is called the "slip", and approximately amounts to about 30 to 40 per cent with the practical propeller.

This slip of the propeller in the air throws a stream of air back from the propeller called the "slip-stream". If there were no slip, then there would be no slip-stream. When the ship is standing still with the propeller rotating, the slip is 100 per cent.

* * *

QUESTION:—Joseph S. Petersen, Indianapolis, Ind. *Will a wing lift when it is dipped down in front, that is, when the angle is a little below a horizontal line? I have heard that this is the case but it seems impossible to me.*

ANSWER:—IF WE take the chord of the wing, a straight-line touching only the "high spots" of the under surface, as our reference line, then most wings will show a lift when the nose is dipped down a few degrees. This is called the "negative angle of attack".

There has been some dispute on this matter, for many consider that the chordal line is not truly the proper reference line if the lift persists after the angle becomes negative. To avoid this apparent contradiction, reference lines other than the chordal line have been proposed as the base of measurement.

* * *

QUESTION:—Robert Burke, Denver, Colo. *I have examined a number of formulae or rules used for calculating the horsepower requirements of an airplane, and am somewhat puzzled over the use of the number "375" in the formula. Just what does this figure represent?*

ANSWER:—THE constant "375" is the result of cancelling out the feet per mile (5,280), the feet per minute and the horsepower-foot-pounds (33,000). After this cancellation is completed we have "375" which is a short and convenient constant.

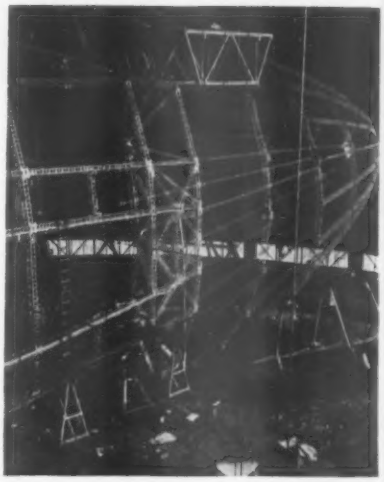
* * *

QUESTION:—Jas. K. Kirk, Richmond, Va. *What is engine "torque" and what use is made of this expression in rating an engine?*

ANSWER:—TORQUE is the expression for turning effort, or the tendency toward turning a shaft. It is comparable to the turning effort exerted by a lever mounted on the end of a shaft. Thus, if a force of 100 pounds acts on a lever 10 inches long, then the turning effort exerted, or the torque, is: $10 \times 100 = 1{,}000$ inch pounds. Now the same thing can be applied to an engine when it is turning a shaft or a propeller. The downward force exerted by the pistons is equivalent to the load above, while the effective length of the crank-arm represents the lever length. With a constant

(*Continued on page* 400)

The Tail Goes Into Place



Construction of the framework of the U. S. S. "Macon" is nearing completion steadily.

A PHOTOGRAPH from Akron, Ohio, shows the tail section of the framework of the U. S. S. "Macon" being hoisted into place. This was done recently at the Goodyear dock.

The ship's skeleton is rapidly nearing completion. It will likely take to the air about January of 1933, to join the sister ship, the U. S. S. "Akron".

Aviatrix Likes U. S.

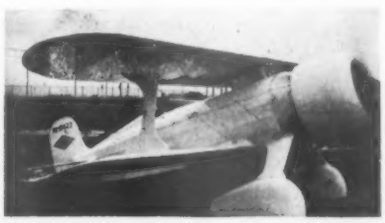
MISS ANTOINE STRASSMANN, one of Germany's pioneer woman aviators, spent four months flying about the United States last year and liked this country so well she has decided to make her home here.

Returning to Germany following the tour, she obtained another passport to come back, and now she plans to take out citizenship papers as soon as she is eligible. At present she is at Lake Placid, N. Y.

A Super-Solution for Private Use

SOME aviators are born naturally lucky. Mr. N. Strohmeyer, a sportsman flyer, has had this Laird Super-Solution built for his personal use.

Nothing need be said of the merits of this plane. It has been lauded in these columns before.



An excellent view of the speedy little Laird biplane.

We Now Have a Bombardment Branch of the Air Service

by ELLEN RANDOLPH

The First Bombardment Wing, a new institution in our Army Air Corps, has recently been put into service at March Field. Its present strength is 90 aircraft which will later be considerably increased.

U. S. Army Air Corps Photo

Getting the bombs ready for a bombing practice expedition requires a lot of work.

THE Army Air Corps is receiving no little notoriety in the Public Press. Some of this criticism is most justly deserved. There is no question of what a great deal of money and effort have been spent, uselessly and needlessly, by "The Powers That Be". Other moneys have been spent unwisely.

Be all this as it may—there is a lot of criticism being passed out that is most unjust. The morale of the personnel is wonderful. Such equipment as is available is maintained in excellent condition. Using such of this material as is at hand, the organization is maintaining its standard of excellence and accuracy in a most commendable way.

An illustration of this is the new Bombardment Wing that has just been organized at March field, Riverside, California. Under the command of Col. H. H. Arnold, in charge of the Post, and Maj. Carl Spatz as Wing Commander, an extensive program has been organized for the finest training ever seen in this country. This Wing is the first permanent organization of its kind ever created in time of peace.

March field has been used for some time as a training camp for primary students. They have been transferred to Randolph field, San Antonio, Texas.

The organization of the First Bombardment Wing consists of the 7th Bombardment group and the 17th Pursuit group. The former includes Headquarters Squadron, the 9th Bombardment Squadron, the 11th Bombardment Squadron, the 31st Bombardment Squadron, the 70th Service Squadron and the 23rd Photo Section. The units of the 17th Pursuit Group are the Headquarters Squadron, 34th Pursuit Squadron, 73rd Pursuit Squadron, 95th Pursuit Squadron and 64th Pursuit Squadron.

In addition to these groups, there is the first Bombardment Wing Headquarters, and Administrative organization which includes the Wing Commander, staff officers, and a small detachment of enlisted men.

While the Wing does not have its full complement in the matter of aircraft at this time, its present strength in number of aircraft is:

55 pursuit planes
25 bombardment planes
10 miscellaneous planes

Approximately 110 pilots are on duty at the field. In number of pilots, and supporting personnel as well as number of aircraft, the First Bombardment Wing represents the largest permanently based tactical organization in the Air Corps at this time.

U. S. Army Air Corps Photo

Trucking the bombs out to the ships with a specially constructed trailer propelled by a tractor.

THE huge bombers, "dreadnaughts of the air", are of two types. The 11th Bombardment Squadron is equipped with Curtiss Condor (B-2) bombers. This ship is powered with two 600 h.p. Curtiss "Conqueror", water-cooled engines, traveling a speed of over 100 miles per hour with full military load, which includes pilot and co-pilot in the cockpit; a combination bomber and machine gunner in the nose; a mechanic gunner in the left "nacelle", and a machine gunner-radio operator in the right "nacelle". For the benefit of the layman, the "nacelles", which resemble an auxiliary "sun porch", sit slightly to the right and left of the fuselage and are built into the wing immediately behind the engines.

The second type of bombardment plane in use by the Bombardment Group is the Keystone (B-3A). These planes are powered by dual Pratt & Whitney "Hornet" engines. These air-cooled 525 h.p. engines enable this type bomber to develop a top speed of 114 miles per hour with full military load of over 1½ tons of bombs and a crew consisting of pilot and co-pilot in the cockpit; a combination bombardier and machine gunner in the nose, a rear machine gunner operating from a cockpit aft in the fuselage and a radio operator working inside the fuselage. The "ceiling" of bombers is about 20,000 feet.

The pursuit squadrons are almost en-

tirely equipped with Boeing P-12-E's. These ships are powered by a 525 h.p. Pratt & Whitney "Wasp" engine. They cruise at 140 miles per hour and have a top speed of 200 miles per hour.

Flying operations in the First Bombardment Wing were begun November 9th last. Six pursuit ships constitute a flight of pursuit and three bombardment planes constitute a flight of bombers. During the present time much flying is also being done in squadron formation. Eighteen pursuit ships form a pursuit squadron and nine bombers a bombardment squadron. When all training has been completed the two groups will combine and take the air as a *Wing*.

The status of this field in a war program would probably be that of an advanced training center, where pilots and personnel would receive their final training and squadrons would be dispatched to the theatre of war from this point. As a defensive factor the field is of great strategical value as a base for an aerial armada that could arrive quickly at most any point on the Pacific Coast or the Southwest border country to participate in either an offensive or defensive maneuver.

The dual engined bombers furnish a graphic example of the development of aerial bombardment since such an offensive was first used by the Italians in Tripoli in 1912. The Curtiss Condors of the type used by the 11th Squadron have successfully carried 4,000 pounds of bombs in recent tests at Aberdeen Proving Grounds.

BOMBS are of different weights, varying from 17 to 4,000 pounds. The different types of bombs are: *Demolition, Fragmentation, Chemical.*

Demolition bombs are used almost entirely by bombardment squadrons. The Ordnance Department is accommodating in the matter of sizes offered and if you are a duly authorized bomber—member of an "egg layer" organization—you may choose between 100, 300, 600, 1,100, 2,000, and 4,000 pound, depending upon whether you want to "pay your compliments" to the skipper of a light cruiser, the captain of a dreadnaught, or the managing director of a hostile munitions plant, harbor defense, or railroad yard! Demolition bombs are so constructed that they *penetrate* deeply before exploding, thus adding to their destructive power when aimed at a battleship, munitions dump or similar target.

Fragmentation bombs are of a much lighter type than demolition bombs and are used by pursuits. They come in 17 lb., 25 lb. and 30 lb. sizes, but 25 lb. is the standard pursuit size. This type explodes instantaneously upon contact with a target and scatters for many yards in the form of small, highly destructive fragments. They are dropped by the pursuit against ground troops as an auxiliary to demolition bombs. The fragmentation bomb is also employed by the low flying, high speed, attack planes in "strafing" trenches, machine gun nests and truck or wagon trains.

Chemical bombs are generally of a standard 30 lb. size. They are filled with titanium tetrachloride and white phosphorus and are employed by pursuit and attack ships when on missions in support of their own ground troops. Their power to form heavy smoke screens renders them invaluable in masking enemy observation posts or in protecting friendly troops moving into an attack.

Neither bombardment nor pursuit has overlooked the little item of machine guns. The pursuit ships each carry two Browning machine guns. These are fixed, mounted on the front of the cockpit and synchronized with the propeller. They fire 1200 rounds (.30 cal.) per minute.

The Curtiss Condor bombers are often referred to as ships without a "blind spot". This means that the three twin Browning flexible machine guns carried on these huge planes are so distributed as to enable the gunner to sweep the sky toward any angle

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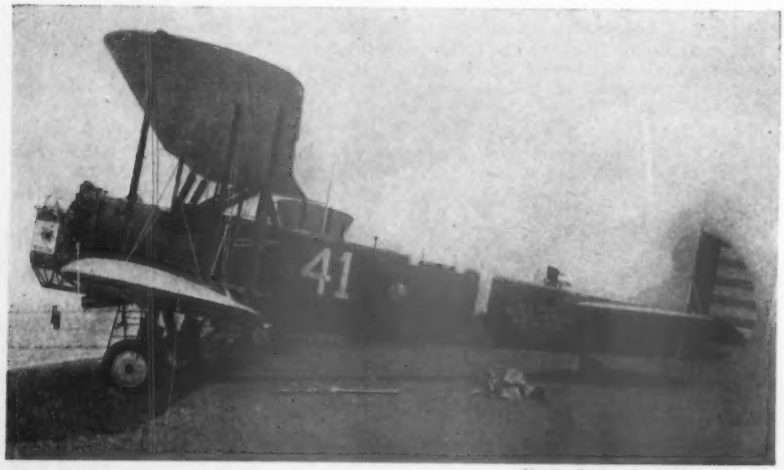


U. S. Army Air Corps Photo.

The Keystone B-3-A heavy bomber in use by the U. S. Army Air Corps.

A More Stable Parachute

Two triangular type parachutes descending. Note the peculiar triangular form of the skirts.

TWO parachute jumpers at Mitchell Field, New York, are shown using a triangular type chute.

These parachutes are of a somewhat triangular shape as compared with the conventional circular type. Oscillation with these chutes is practically eliminated. Many injuries have been caused previously on landing by the violent oscillations that are so frequently experienced. This picture is printed in response to the requests received from a number of readers.

Business Uses Air Mail to Save Interest

ACCORDING to an estimate published by the Aeronautics Branch of the U. S. Department of Commerce, $24,000,000 in the form of bank clearings, remittances and negotiable securities arrive in New York City by air mail daily. Obviously air mail is used for this purpose because of the savings involved. However, air mail, which is now averaging 750,000 pounds per month, is not solely business mail. There is an increasing volume of general and social correspondence in the air mail bags.

Another Attempt at the Stratosphere

COUNT ZICHY and Herr Hans von Braun, both of Vienna, Austria, will attempt to conduct experiments in the stratosphere, ten miles above the earth, in a ball-shaped aerial basket.

The balloon, especially constructed, will soon be ready for the ascent which will be made this month, from Mauer, near Vienna.

What Our Readers Are Building

A department devoted to our reader's activities in airplane and glider construction.

Kohler, Wisconsin Gliding Club

FROM Milwaukee, Wisconsin, we have just received a very interesting letter from John F. Keller, who is the "reporter" for the Club. The Club started a year ago with six members. A primary glider was purchased and short hops were taken. The hops were made with the assistance of a Stanley Steamer auto and 1,500 feet of rope. An altitude of several hundred feet was attained.

During the year the Club has been in existence, the membership has increased to 30 active students. A lightplane has been included in the Club equipment. Out of 1,500 flights in the glider and a 1,000 hours in the lightplane, there have been no major crack-ups or injuries.

We want to congratulate this Club on its development and hope to hear from them in the future.

A Penguin Seaplane Arrives

Here's the penguin seaplane on the way to work.

HERE we have a real novelty—a penguin seaplane or a seaplane without wings. But the modest constructor of this fine little ship forgot to sign his name to his letter, and left out his address, so he remains shrouded in mystery. However, he gives us the specifications and calls particular attention to the method of transporting the ship.

Length	13 ft., 6 in.
Height	5 ft., 3 in.
Engine	Harley "Twin"
Propeller	6 ft. Diam.

PONTOONS

Length	8 ft., 7 in.
Width	1 ft., 0 in.
Depth	1 ft., 0 in.

This is a good idea, and we believe that this little ship could make mighty good time over the water. Maybe Mr. Blank will reveal his identity some time.

He claims that the only changes made on the Chevrolet engine were a change from the old battery system to a magneto, the installation of a Hudson oil pump and a slight change in the cooling system.

Mickalson Shows a Nifty Looking Monoplane

Erling Mickalson standing by his homebuilt monoplane, powered with the well known Ford engine.

ERLING MICKALSON, of Roseau, Minn., is glad that we have the Reader's Page. He thinks it is a great idea. Thank you, Erling.

After giving us that nice bunch of roses, he tells us of his lightplane. He is another flyer who backs Henry Ford when it comes to small engines.

He says that the plane with its 29 foot wing and a U. S. 35A airfoil performs about the same as an O X Travel Air.

He recommends this wing section for fast climb, but says it is not so hot for glides. For winter service he has a set of skis, but this winter has not been adapted for such take-offs.

Fine going, Erling, many happy landings.

The Auto-Powered Pietenpol Lightplanes

BELOW is seen an interesting lineup of three Pietenpol lightplanes, all of which are powered with automobile engines and which are successful fliers. B. H. Pietenpol has been building and flying lightplanes for twelve years and has been conspicuously successful with Ford and Chevrolet power plants.

The ship powered with the Model "A" Ford engine has been built for four years in which time it has proved to be a strong, good flying ship. Up to date there have been no accidents with this model although several men have made their first solo flight in it.

In the latest ship, a few improvements have been made. Instead of the landing gear shown, it now has a split axle landing gear, a steerable tail skid and an underslung radiator.

The following specifications will be of interest to lightplane fans.

SPECIFICATIONS OF TYPE B-4-A

Span	28 ft., 2 in.
Chord	5 ft., 0 in.
Length	17 ft., 7 in.
Height	7 ft., 0 in.
Empty weight	625 lbs.
Power	Model "A" Ford engine
Cruising speed	60-70 m.p.h.
Climb	300 ft. per min.

This ship will carry two 165 pound persons and 8 gallons of gasoline. It is the lowest price practical ship on the market, selling at $850.00, fly-away at the builder's field.

A group of three Pietenpol monoplanes powered respectively with a Ford "A," a Chevy engine and an engine out of a Velie car.

A Cross Country Flivver

Quite a hot looking crate.

IRVING QUINN, of Roebuck, South Carolina, Route 1, sends in this picture of his cross-country lightplane. The entire plane was fabricated from raw materials with the exception of the engine, a 23 model Chevrolet with a 28 model head.

The plane takes off at about 250 feet. Its top speed is about 70 miles an hour. Its landing speed at about 25 miles. The wing spread is 31 feet with a six feet chord. The length overall is 20 feet. The total weight, including the pilot, is 650 lbs.

With the exception of the engine, which is unenclosed, the plane has a nice appearance. Fine work, Ervin! Hope you make some nice cross-country flights this season, too.

A Powered Glider

R. V. Grogg's powered glider.

ROGER V. GROGG, 104 Washington St., Auburn, Indiana, sends in the first story of a powered glider we have had in several months.

It is powered with a 2 cylinder Henderson, developing about 8 to 10 h.p The span is 36 ft. 6 in. and the weight empty is 300 pounds.

Grogg is an expert welder and used his ability to make a welded tubular frame. The Gottingen 441 wing section was used.

Mr. Grogg is interested in powered gliders and would be glad to hear from others who are figuring on powering their ships.

A Pittsburgh Lightplane

A flying school in Pittsburgh has constructed an interesting lightplane of which the fuselage is shown below. Many novel features are incorporated in the ship including the airwheels.

The Pittsburgh product near completion.

Lightplane Clubs in Canada

THE light airplane clubs from Coast to Coast in Canada enjoyed a year of reasonable activity, according to club statistics for 1931, which were released recently.

Twenty-two clubs, having an aggregate membership of 2,973 and making use of 65 aircraft, had 11,958 hours of flying during the 12 months. One of the chief purposes of the clubs is to teach flying, and the figures show that 535 pupils were under instruction and that 269 of them became soloists before the year ended. The number of private licenses issued under club auspices was 110, while 47 members obtained their commercial licenses.

The most active club in the Dominion in the matter of actual flying was the Edmonton and Northern Alberta Club at Edmonton, which had 1,290 hours to its credit with five airplanes. The Toronto Flying Club, with six machines, was a close second, with 1,221 hours. The Toronto club membership is 275, as compared with the Edmonton club with 134 members.

The grand total of 11,958 hours for 1931 compares with 14,686 hours flown by the clubs in 1930 and 16,612 hours in 1929. The total flying time in 1928 was only 8,124 hours. The flying of all clubs for the four years was 51,382 hours. The aggregate club membership in 1928 was 2,403, as compared with 2,973 in 1931. The clubs had only 34 airplanes in 1928, as compared with 65 aircraft at the end of 1931.

Two Readers and One Glider

Another P. T. G. that has seen good service.

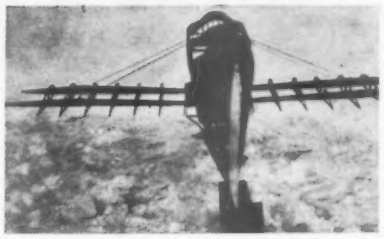
TWO of our readers have completed this primary glider and have made over 100 successful flights. No serious crackups. They have been towed by auto and by a Cris-Craft on the Manesquan River. They have been able to attain 400 feet altitudes. Several close calls have added to the thrills of their experiences.

If any one is interested in getting in touch with these boys, write Warren Merboth, 405 Doremus Ave., Glen Rock, N. J.

Few Open Cockpits Today

FOUR years ago open cockpit planes were most numerous among models licensed. However, during the past four years, open designs amounted to only slightly more than half of the total.

A Lightplane Racer



A good looking monoplane—what?

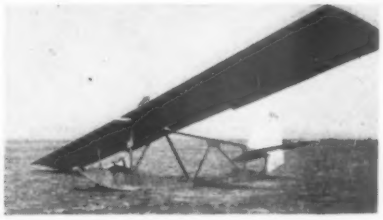
AT LAST we have a racing job in the lightplane class. Ernest Schoul, Preston, Idaho, is the designer. The first paragraph in his letter tells the story. Here it is:

"I am sending you a photo of a lightplane racer I am building. It is a monoplane which has a span of 14 feet, chord of 2 feet 9 inches, area of 32 square feet, and a length of 10 feet 9 inches.

It has a single wheel landing gear, which I think will be very good. It also has extra large ailerons so it can be balanced at speeds as low as 5 m.p.h."

The photograph is very interesting. These construction photos are fine, and we do not get very many.

California Gliding



This P. T. G. looks like a well built job.

CALIFORNIA seems to be a great locality for gliding. Every month we get many letters from our readers there, describing gliding and soaring flights.

The glider in the illustration was built by Elmer Swanson, of Los Angeles, and two friends. He tells us in his letter that No. 184 W cost only $80 to build. So far, they have had four crackups, but no one was hurt. After the last crash they had to do some extensive rebuilding, but the glider is going strong again.

Williamson's Flying Flivver

J. N. WILLIAMSON, Charlotte, N. C. has built a flying flivver. It is powered with a modified model "A", rated at 60 h.p. The regular Ford radiator and hood give the ship a very trim appearance.

The plane weighs 550 pounds, has a wing spread of 31 ft., with a chord of 6 ft. 2 in. The landing speed is low, around 20 m.p.h.

New Ideas for Our Model Builders

New Model Building stunts of interest, gathered from far and near for our readers.

Model Department Is Progressing

THE model department is going right along. We had some fine material this month. Unfortunately a lot of it came in too late. Well, there will be plenty more issues of P. A. for them.

May we make a little request? Fine. Thanks. Try to have a little more contrasting background, fellows, for your photos; it makes it easier to see the model. And here is another thing; it is not the size of the photograph that counts, it is the size of the model in the picture. We had to pass up two fine models this time because they were not large enough to show. Regardless of the size of the camera, please see that the model itself is at least two inches across.

Well, here we go, fellows, with this month's crop of models. Pretty fine, sez us!

Something Different

The Sikorsky scale model.

HERE is the first model of a Sikorski Amphibian that we have had in a long time. Edward Dailey is the maker. He comes from 104 27th Ave., Elmhurst, L. I.

The model is made to scale, although Ed does not tell us just what the scale is. It is a fine looking job.

Ed tells us that he would like to get in touch with some people who would like to buy his models. One look at this photograph should "sell" anyone who was the least bit interested.

A Professional and An Embryo

FLIGHT LIEUTENANT R. L. ACHERLY of England is interested in the model of William Griswald of Chicago.

Griswald has just won first place with his model in the event for hand-launched planes. The event was part of the National Model Meet. The time was 1,065 seconds (17¾ minutes).

Lieutenant Acherly is the noted British flyer who gave the wonderful exhibition stunt flights during the 1930 and 1931 National Air Races.

A Flying Lockheed Vega

A mighty quick snapshot of the "Vega" just after launching.

The Lockheed "Vega" just before releasing it. Note the beauty of construction.

GEORGE MUELLER, of Chicago, Ill., is just about to launch his Lockheed Vega. Yes! This is one of the models that has appeared in Joe Ott's department in POPULAR AVIATION.

No joking, isn't it a mighty fine model? It flies like a bird, and nearly as high as the planet for which she is named. This view of a model is very rare on these pages. Notice how the sunlight, passing through the thin paper, shows in detail the framework. Yes, sir! A fine model and a fine photograph.

Whirr-r-r-r-r-r-r-r! Off she goes. The Vega is stepping away, and at a snappy clip. Put your hand so as to cover the boy. Unless one knew that it was a model, who would doubt that it was a real ship in flight? If the proof of the pudding is in the eating, then the proof of a plane is in the flying. This plane is surely proved.

George Mueller is the boy, and he can be reached at 3335 Eastwood Ave., Chicago, Ill.

A "Q-M" Model

Eugene Johnson's "Question Mark".

WHAT is it????? It is a flying model of the famous "Question Mark", the plane that a few years ago made an endurance record.

Eugene R. Johnson, 1420 Otter St., Franklin, Pa., is the maker.

A Heath Flying Model

A Heath Parasol scale flyer.

WILLIAM ESLER, 1550 Lake Drive, Grand Rapids, Mich., sends in his contribution for the model page with a flying model of a Heath. The model has a wing spread of eighteen inches, and flies fine. Fine stuff.

Building the "Green Jay" Duration Model

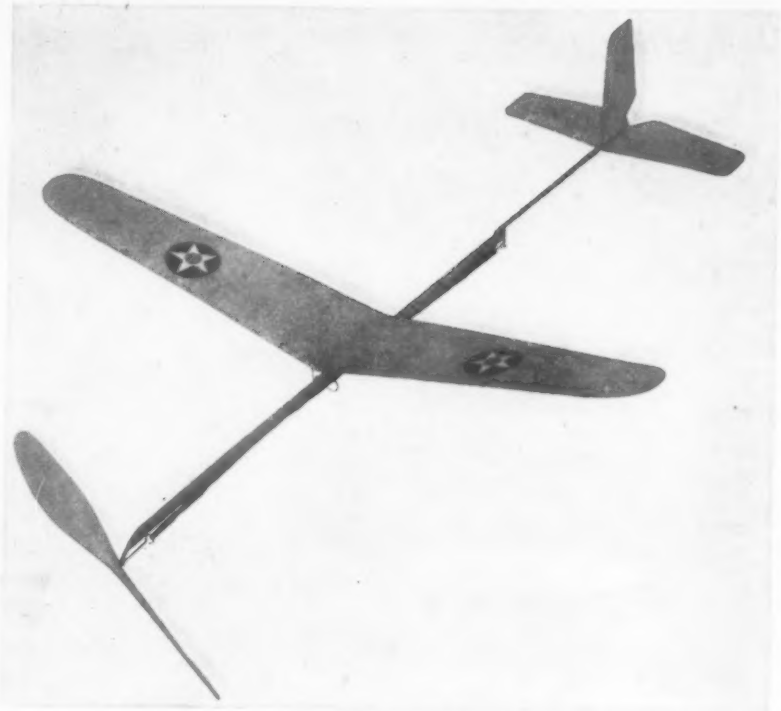
by "POP STICK"

THIS is strictly a duration or contest type of flying stick model, designed to obtain the longest possible flying time. The design itself is very simple. The parts used in constructing this model need not be of the lightest materials obtainable.

The model constructed for this article was built strong and sturdy but stream lined to a very high degree. At first glance it appears that stream lining a model of this type is not very necessary, but it is good practice to make the trailing edges very thin both on the wing and tail units. The rear end of the motor stick should also be brought to a tapered wedge.

The propeller should be of a medium pitch not necessarily of the lightest balsa obtainable, but should be sanded to a true wing curve section. The wing has a slight cambered surface on the under side. The stabilizer is flat on the top side and convex on the lower side. Referring to the photograph, notice that the tail unit is held in place by a boom attached at the top side of the rear end of the motor stick.

This model flies very fast and gains altitude rapidly. Once in the upper air currents the model is apt to be lost to sight quickly. Bear in mind when trying the model in its first flight that if it does not climb rapidly it may be taken for granted that long duration flights may not be obtainable, as height and the upper air currents continue to carry the model after the power has been expelled.



Many model contests are being held this Summer. POPULAR AVIATION presents the Green Jay for your entrant in the duration event.

ABBREVIATED BUILDING INSTRUCTIONS

1. Wing.
2. Body—Motor stick.
3. Tail.
4. Propeller.
5. Fittings.
6. Rubber strands.
7. Covering.
8. Flying.

1. Wing

THE ribs should be cut out first. The sizes can be secured by making a full size layout of the top view of the wing. One-half of the wing will be sufficient, so that the proper thickness and taper of the wing is secured. Sketch the front of the wing covering the thickest part at the center ½ inch, and the thinnest part 3/16 inch near the tip. The length of the rib should be taken from the top view of the full size sketch.

The left and right side wing is assembled and cemented at the center, including at this time the correct amount of dihedral—2½ inches. The nose ribs should be added after all the ribs, trailing, and entering edges are in place. The wing tips are made of bent bamboo. The drawing clearly illustrates how these are cemented in place.

2. Body-Motor Stick

THE body or motor stick should be a firm piece of balsa, 5/32" x 5/16" and 24 inches long. No detailed explanation is necessary to make this part of the model. It is kept to the given dimensions throughout the entire length with a slight taper at the rear. The side view of the drawing clearly illustrates the arrangement of the fittings and parts.

LIST OF MATERIALS

1. Body—5/32 x 5/16".
2. Spar—1/16 x ⅛".
3. Entering Edge—⅛ x ⅛".
4. Trailing Edge—3/32 x 3/16".
5. Sheet Balsa—1/32 x 2½".
6. Propeller—10" Diam.
7. Tail Balsa—1/16 x 2½".
8. Bamboo—1/16 x ¼" x 12".
9. Thrust Bearing Steel.
10. Washers—⅛" O. D.
11. Rubber—1/32 x ⅛" x 8'.
12. Tissue—21 x 31".
13. Piano Wire—.024 O. D. 5'.
14. Cement—2 oz.
15. Dope—2 oz.
16. Green Tissue for wing.
17. Tail Boom—⅛ x ⅛".

3. Tail

A FULL size layout should be made of the stabilizer and rudder. To simplify drawing these various parts to full size, begin by laying out and securing the sizes covering the length and width over all. Then mark off the smaller dimensions on the ends and the various tapers so that the proper shape is secured. Round off the corners as illustrated in the drawing.

Both sides of the stabilizer should be drawn so that work can be carried on directly over the face of the sketch. The spar used in the stabilizer is 1/16 x ⅛". The ribs are 1/32 inch thick. The stabilizer edges are 1/16 x 3/32". The entire outline of the rudder and stabilizer is built up balsa pieces. One side of the stabilizer is flat and the other side has a slight curve. In this model the flat side is placed up, just the reverse to a standard wing. The entire tapered parts, the rudder and stabilizer are cemented to a small piece of balsa ⅛ inch square, which is called the boom. This in turn is cemented to the rear part of the motor stick.

4. Propeller

THE propeller is ten inches long and of a medium pitch. When using a high pitch propeller in order to secure the maximum speed of the model in flight, it is necessary to use more rub-

ber. This in turn cuts down the amount of revolutions or rubber turns obtainable. Standard practice of carving a propeller should be followed. The general dimensions of the propeller used in the contest model are as follows: ⅞" x 1" x 10" with a pitch of 14 inches.

If the propeller is very efficient and the model is stream-lined well, the theoretical distance obtainable will be 1000 feet on 1,000 turns. The height obtainable while a thousand turns are being used up should come close to 300 and 400 feet. If the model rises well over 200 feet in height it has good chances of staying up about three minutes. If it goes 400 and 500 feet, the chances are it will be lost to sight as the upper air currents will continue to carry it on.

5. Fittings

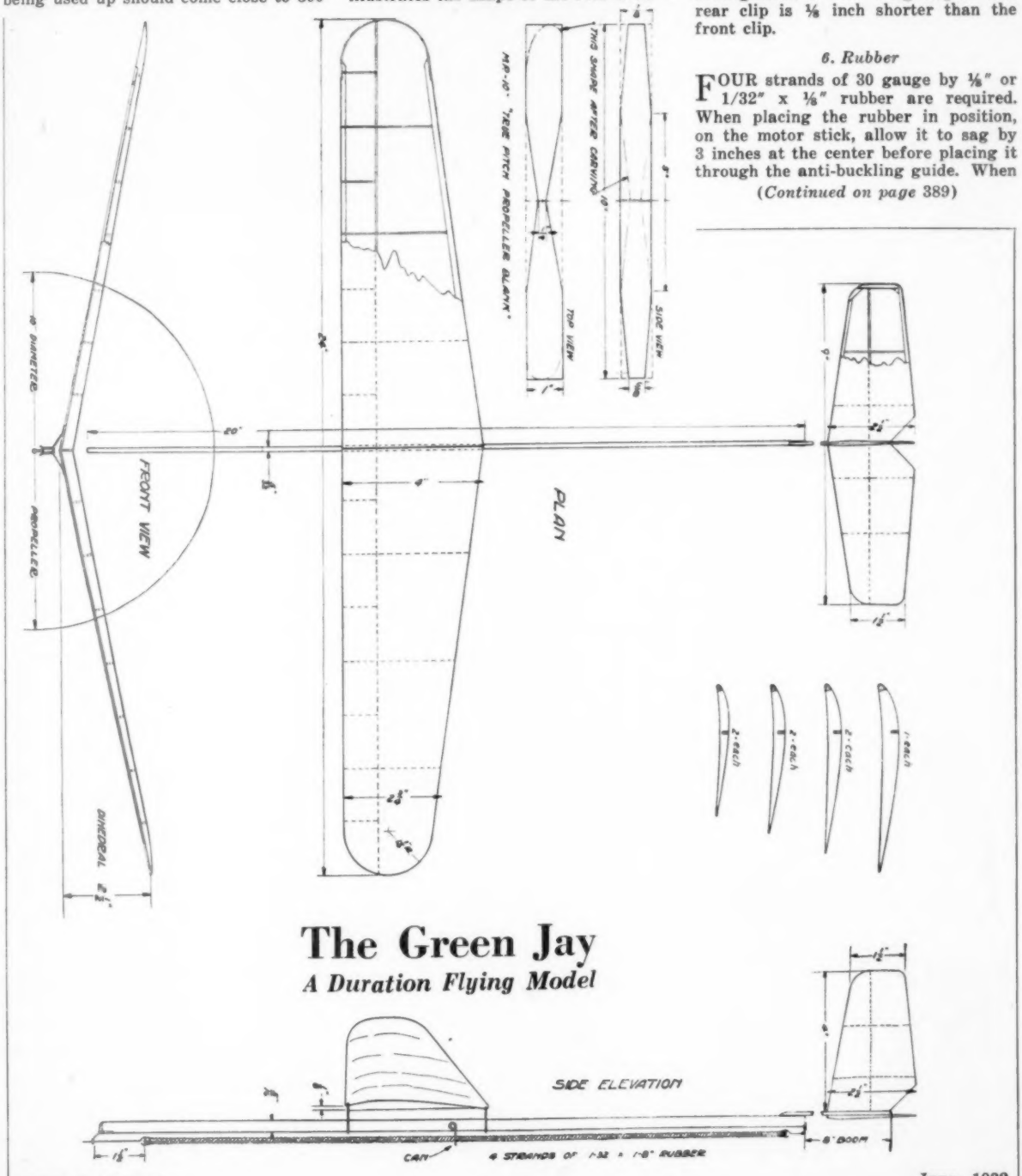
TINNED piano wire with a diameter of .024 inch is used in all of the fittings. The side view of the drawing illustrates the shape of the rear hook—the "S" hook—the can or anti-buckling guide, and the propeller shaft. The thrust bearing is of a medium weight. The center line of the shaft should be 3/16 inch from the bottom of the motor stick. This same height is maintained by the rear hook. If a greater distance is used between the center line and the motor stick the tork of the strands increases the twist on the motor stick which is undesirable.

The front view plan illustrates the arrangement of the wing clips. The rear clip is ⅛ inch shorter than the front clip.

6. Rubber

FOUR strands of 30 gauge by ⅛" or 1/32" x ⅛" rubber are required. When placing the rubber in position, on the motor stick, allow it to sag by 3 inches at the center before placing it through the anti-buckling guide. When

(*Continued on page* 389)



The Green Jay

A Duration Flying Model

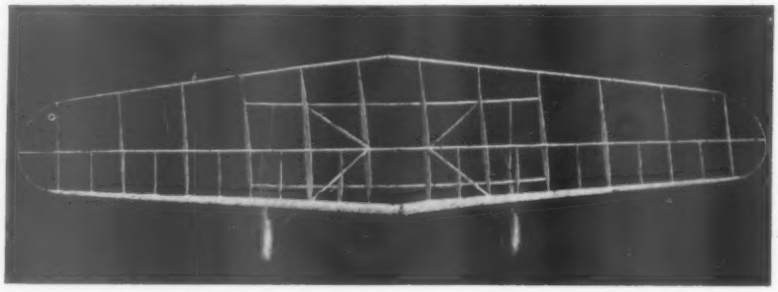
Building the Lockheed Orion

by JOSEPH S. OTT

This scale flying model is an exact reproduction of the ship described on page 365 of this issue.

A LOW wing flying scale model is no harder to build than a high wing, but to increase the stability of the model it is necessary to build the fuselage extra light and to increase the dihedral in the wing. The increased dihedral will help to bring the center of gravity lower on a low wing monoplane. To decrease the weight of the fuselage the motor stick on this model has been left out. In this instance a "U" type thrust bearing is secured to two cross members at the nose of the model and the rear section that holds the rubber in place is built up of small sections of balsa wood with a cross member that fits into a slot.

The side elevation clearly illustrates the arrangement of the rubber motor and its attachment into the fuselage. Note the two additional members that help to brace the upright which carries the cross-member holding the rear end of the rubber motor.



Showing the frame-work of the "Orion" wing ready for covering.

Wing—Ribs

THE ribs are illustrated in full size for a twelve-inch model and should be doubled or tripled for the twenty-four or thirty-six inch model. Lay out a full sized chart, after deciding upon the size wanted and cut the ribs out ready for assembly into the wing. As the ribs become smaller in height and shorter in length towards the tip, it is best to use only one spar as illustrated. This should run straight through all the ribs on the top side. Additional bracing is secured by the two small auxiliary spars running for a short length on either side of the center. The square dimensions of these auxiliary spars should equal about one-half of the main spar.

Note that two additional angular braces are placed from the first rib which rests up against the fuselage to the second rib, meeting the auxiliary spar at the rear and the other one butting up against the entering edge at the front.

After the wing has been assembled and the leading and entering edges have been put in place, a nose rib between each main rib is added. These maintain the curve of the leading edge of the wing. Utmost care should be exercised when assembling this wing so that there is no warp on either side. Keep the flat or under side of the wing perfectly even.

At this time it is best to check on the angle of incidents and the front auxiliary spar should be about 3/32 of an inch narrower in depth than the rear one. It will be necessary to add material on top of these spars so that they will touch the lower part of the fuselage longerons and at the same time the lower part of the wing should be kept even with the lower-most part of the body. The side view will illustrate the approximate height which must be added to the auxiliary spars.

A view of the completed "Lockheed Orion" model—a beautiful piece of work and an excellent flyer.

Landing Gear

THE front view illustrates the upright braces necessary to hold the landing gear rigid. The large plane carries a retractable chassis. On the model, the additional weight required for this type become excessive when the model is used for flying purposes only. It may be added, however, by using eyes and hooks on the upright pieces and a small catch on the angular brace with an additional swivel on the inside of the wheel which allows this brace to fold up with the wheel into the underside of the wing.

On the side elevation the landing gear is illustrated with the wheel in a stream-lined housing. The large upright strut seen in this view is balsa stream-lined with a bamboo leading edge which prevents snapping. The wheel pant is made up of one filler and two thin sheets for the sides. Use very light wood for the filler in this case. After cementing these parts together, sandpaper the back to a point from the top and side views, and round off the rest of the pant.

Body

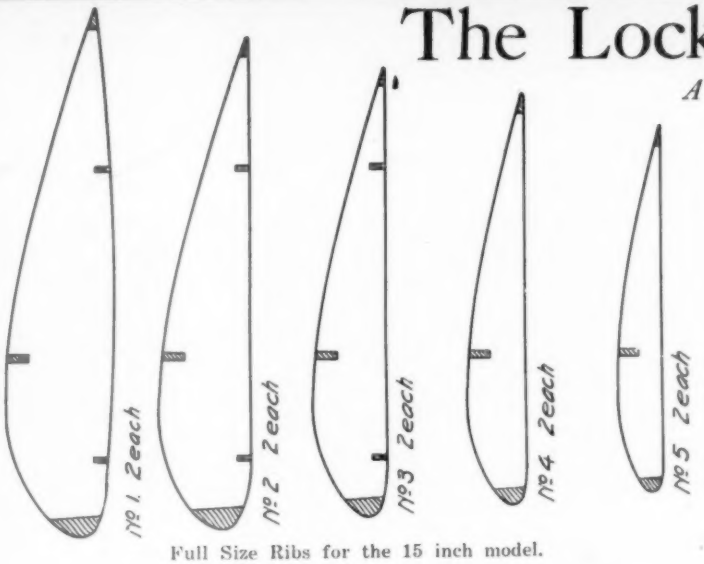
A LARGE sketch of the body side should be drawn to fit the scale to which the wing has been built. If a thirty-six inch size is desired, the longerons should be approximately 3/32 of an inch square. For the twenty-four inch model the longerons should be half-way between this size and 1/16 of an inch, or approximately 5/64 inch square.

After the two sides have been assembled they should be united as shown on the plan or top view with the cross-

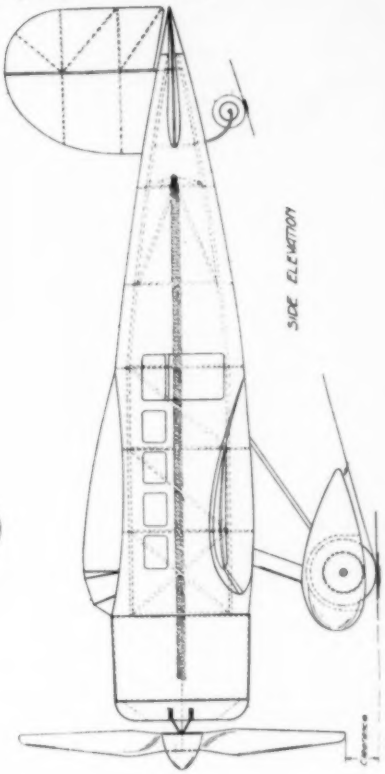
(*Continud on page* 388)

The Lockheed Orion

A Flying Scale Model

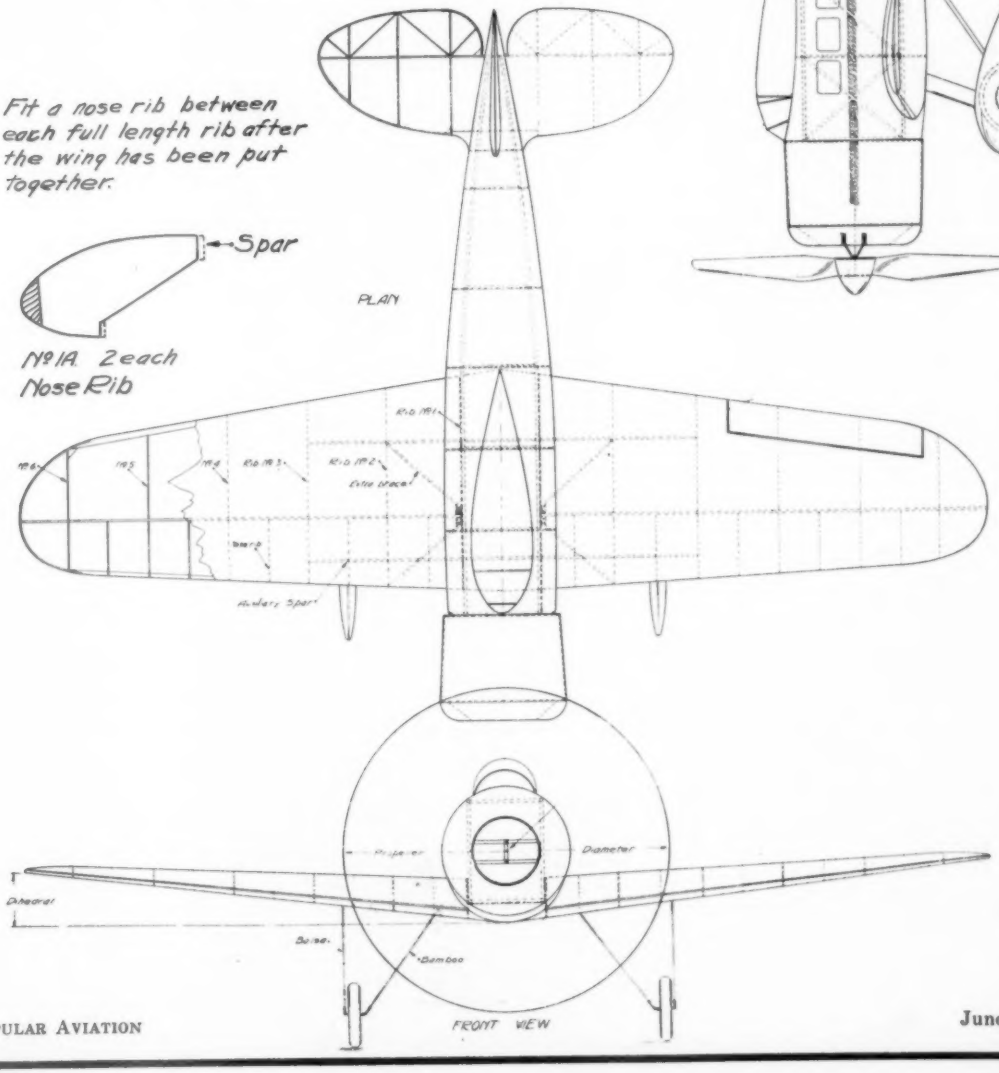


Full Size Ribs for the 15 inch model.



Fit a nose rib between each full length rib after the wing has been put together.

No. 1A 2 each
Nose Rib



Lockheed "Orion" Model

(*Continued from page* 386)

members for the upper and lower braces of the same length. Before cementing the body formers in place, the nose of the model should be completed and cemented to the front end. The body formers will follow the general shape of the nose. Note that the body is a trifle deeper on the side view about midway at the wing.

The engine cowl or nose is built up of thin sheet balsa, 1/32 of an inch thick or lighter, and the very front or nose ring is made of one solid turned or hand carved balsa, which should be a very soft and light piece.

The cross and rectangular bracing in the side of the body prevents the paper from splitting when the body is put under a strain. To help maintain the oval shape of the body, small cross sectional longitudinal stringers or formers are added on each side approximately three between each longeron should be sufficient to maintain a smooth curve.

The cross section illustrating the oval shape of the body shows the general arrangement of the longerons, the formers and the longitudinal members. Where the wing meets the body and the formers curve near the main spar, a narrow longitudinal strip ⅛ of an inch wide, having the same curve as the upper part of the rib, is cemented to the formers, to which the tissue is attached when covering the model. The point of body at rear is solid balsa.

Tail Surfaces—Rudder and Stabilizer

THE outline of all the tail surfaces is made of bent bamboo with ribs of light balsa and the spar and the stabilizer should be in one piece, so that one side does not warp up or down. The side elevation of the stabilizer gives the correct size of the rib shape. On the twenty-four inch model the tail surfaces need not be covered on both sides, and when covering only on one side, the ribs and spars are much thinner, so that they offer much less resistance. The tail wheel is held in position with two small pieces of bent bamboo, which in turn are securely cemented to the upright cross brace, as illustrated in the side elevation.

Cabin

THE top of the cabin to the rear of the last upright is made of a solid piece of very light balsa, hollowed and cemented in place over the formers. The front part is built up of two parts of light celluloid, to give a realistic appearance. The windows and the door are outlined in black tissue paper, pasted on a white body covering.

Covering

THE entire body is white with an aluminum or silver nose. The vertical fin is white. The rudder is red tissue with a ⅛ inch black line running up and down, dividing the fin and rudder. The under side of the wing and stabilizer is white. The top side is in two colors, red and white, dividing the wing crosswise. A black line is added at the point where the red and white sheets meet.

The red and white sheets are cemented together first and then attached to the top of the wing. The same color scheme is used on the stabilizer. All the struts are painted black and the wheel pants are red. The complete covering should be given one spray coat of water. Do not use dope or banana oil to draw the tissue taunt, if hakone tissue is used.

Propeller

THE propeller diameter should be nine or ten inches for the twenty-four inch model and eleven or twelve inches for the thirty-six inch model. The pitch should be equivalent to one and one-half times the diameter, with a nose spinner added when complete. Eight to ten strands of rubber will be necessary for the thirty-six inch model and six to eight for the twenty-four inch model.

MATERIALS REQUIRED

For the 24" Wing Span Model.

Wood

Spars, 1/16 x 3/16 x 30", balsa, 2 pieces.
Trailing edge, 1/16 x 1/8 x 30", balsa, 1 piece.
Entering edge, 3/32 x 3/32 x 30", balsa, 1 piece.
Longerons, 5/64 x 5/64 x 30", balsa, 1 piece.
Rib stock, 1/32 x 2 x 30", balsa, 2 pieces.
Motor base, 3/16 x 1/4 x 30", balsa, 1 piece.
Motor nose, 1/2 x 2 x 3", balsa, 1 piece.
Propeller, 8" diam., balsa, 1 piece.
Stabilizer, 1/16 x 1/4 x 15", bamboo, 1 piece.
Rudder, 1/16 x 1/4 x 15", bamboo, 1 piece.
Landing gear, 1/16 x 1/4 x 15", bamboo, 1 piece.
Wing tips, 1/16 x 1/4 x 15", bamboo, 1 piece.
Struts, 1/16 x 1/4 x 15", bamboo, 2 pieces.

Fittings

Motor, 1/32 x 1/8" x 10', rubber.
Bearing, Special "U" shape.
Shaft, .024 diam., tinned piano wire.
Axles, .024 diam., tinned piano wire.
Wheels, 1⅞" diam., celluloid.
Washers, 1/8" O. D.
Tissues, Red and White, 3 sheets.
Cellophane, 2 x 4".
Cement, 1 tube.
Lacquer, Red and Black, small jar.

END

SUPPLIES AT LOWEST CUT PRICES

Super Quality Balsa Wood (20" lengths): 1/16x1/16, 20 for .05; 1/16x3/32, 20 for .05; 1/16x1/8, 20 for .05; 3/32x3/32, 20 for .05; 1/8x1/8, 20 for .05; 1/8x3/16, 20 for .09;1/8x1/4, 20 for .12; 3/16x3/16, 20 for .13; 3/16x5/16, 20 for .16; 1/4x1/4, 20 for .17; 1/4x1/2, 3 for .05; 5/16x5/16, 3 for .05; 1/2x1/2, 3 for .10; 1/2x1, 1 for 06; 1x1, 1 for 11; 1x2, 1 for .20; 2x2, 1 for .30; 2x3, 1 for .40; 2x6, 1 for .60; 3x3, 1 for .50: Sheet Balsa (20" lengths), 1/64x2, 5 for .08; 1/32x2, 5 for .08; 1/20x2, 5 for .08; 1/16x2, 5 for .08; 3/32x2, 4 for .08; 1/8x2, 4 for .12; 3/16x2, 2 for .10; 1/4x2, 2 for .11; Prop Blocks, 1/2x3/8x5, 3 for .01; 1/2x3/4x5, Dozen .10; 1/2 x3/4x6, Dozen. 11; 5/8x1x7, Dozen .15; 5/8x1x8, 3 for .05; 3/4x1½x9, 3 for .05; 3/4x1½x10, 2 for .05; 3/4x1½x11, 1 for .04; 7/8x 1½x12, 1 for .05; 7/8x1½x16, 1 for .09: Planks 2x3x36, .45; 1x6x36, .40; 2x6x36, .80; Sheet Aluminum (12"wide), .002, per ft. .12; .005, per ft. .11; .010, per ft. .13; Washers. Large or small 2 doz. .03; Eyelets, 3 doz. 10;. Double Geared Winders, each. 25; Sandpaper, 1 doz. sheets. .10; Reed, 1/32" diam., 3/64" diam. or 1/16" diam. 6 ft. .03; 1/8" diam., 9 ft. .05; Bamboo, 1/16x12, Doz. .05; 1/16x15, Doz. .07; Airplane Insignia. Stars in circle or bulls-eye (red, white, blue); 1" diam., 8 for .05; 1½", 7 for .05; 2½", 6 for .05; Celluloid Wheels, 3/4". Per pr. .04; 1", per pr. 06; 1¼", per pr. .08; 1¾" per pr. .12; 3", per pr. .25; Aluminum Tubing. 1/16" O. D., per ft. .05; ⅛" O. D. per ft. .05; 3/16" O. D., per ft. .08; Dummy Motors—9 Cylinder. 1½" diam., each .16; 3" diam., each .29; Black Celluloid Pants, pair .25; Black Celluloid Cowlings, each .20; Colored Dope: Colors: Orange, Red, Green, Silver, Yellow, Blue, Black, White, Buff, Navy Grey, Mahogany, Olive Drab. 1 oz. bottle. 06; 2 oz. can, .09; pint can .65; Colorless Cement. 1 oz. bottle, .06; 2 oz. can, .09; pint can, .65; Thrust Bearing. Small and large sizes, each .01½; per doz., .15; Clear Dope, 2 oz., .07, pt. .37; Banana Oil, 2 oz. .07, pt. .37; Acetone, 2 oz. .06, pt. 35; Pure Rubber. No rubber in over 8 weeks old 1/16 flat 50 ft., 12, 225 ft. 50; ⅛ flat 50 ft., 13, 225 ft., 55; 3/16 flat 50 ft. 17, 225 ft. .75; Japanese Tissue. Red, Blue, Green, White, Orange, Brown, and Yellow. 5 sheets, .10; Music Spring Wire. .014, .020, .028, .034, 18 ft., 05.

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Green Jay Model

(*Continued from page 385*)

tying the rubber together, place the knot at the rear around the "S" hook.

7. Covering

HAKONE tissue or super-fine should be used in covering the model. When using Hakone no doping is necessary and to make the tissue taut, spraying by water and allowing to dry is all that is necessary. The tail covering may also be drawn up by spraying with water. Dope may be used in applying the paper to the wood parts.

WHEN the entire model has been completed and all the parts are ready to be assembled for the trial flight, check up and make sure that the wing is not warped on either side. When placed on the motor stick be sure that the correct angle of incidence is obtained. The top part of the stabilizer should be on a straight line with the side of the motor stick.

If the wing is warped slightly on the left or right side a few trial flights will rapidly demonstrate if it is necessary to straighten it out. If it has to be straightened it is best to spray the wing with water, then pinning down into the proper position and allowing to dry. Sometimes it is necessary to warp the model in the wrong direction. It is necessary to counter-warp a little more than just enough because the wood members and the cement in the wings and ribs tend to prevent the wing from being straightened.

The model in gliding should have a very flat angle and will glide very fast. 50 or 100 turns of the rubber will rapidly demonstrate whether the model is in balance under power and the wing should be moved fore or aft as required. Good flying models will glide in the positions in which they fly, the wing remaining at one point. If the wing has to be moved in one position for gliding and another for flying, the duration of the model will be shortened.

END

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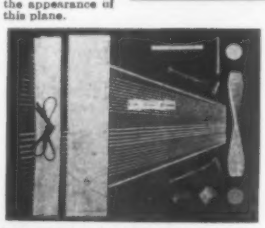

The photograph at the left shows the contents of a LOW WING JUNIOR Kit spread out. More than 30 feet of Balsa sticks are furnished, each size is cut from wood of the proper weight for its purpose. The Lawrence Machine Carved Propeller is cut to the most efficient pitch and the nose and tail blocks are machined to fit. The new Lawrence Shrinkless Cement and Paper Cement are furnished and all the fittings are made.

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LAWRENCE AIRPLANE MODELS
Dept. P6, 1319 Hood Avenue, Chicago

Mechanic's Exams

(*Continued from page 377*)

on contacts. (5) Defective condenser. (6) Burned timer points. (7) Moisture or dust in distributer. (8) Defective insulation.

Q. What causes engine valves to warp?

A. Running on retarded spark, insufficient cylinder cooling, excessively rich mixture, leaking valves, insufficient tappet clearance.

Q. How would you check and adjust the valve clearance on two aviation engines with which you are familiar?

A. Curtiss OX-5, tappet clearance exhaust of cylinder No. 1 = 0.012". All other exhaust tappets = 0.010". Wright Whirlwind (J-5) = 0.031".

Q. In cold weather, if an engine runs irregularly at cruising speed but operates smoothly at wide-open throttle, what must be done to remedy the trouble?

A. Engine is overcooled. Close radiator shutters or make mixture richer at cruising speed.

Q. Describe the purpose of a Venturi tube in a carburetor.

A. To create a suction above the carburetor nozzle so as to draw gasoline out of the nozzle and spray it into the surrounding air.

Q. What material should be used in gasoline lines?

A. Seamless copper tubing throughout with compression couplings.

Q. Explain one complete cycle of a 4-cycle engine.

A. (1) Suction stroke, drawing in mixture. (2) Compression stroke. (3) Ignition at end of compression stroke. (4) Working or power stroke. (5) Scavenging stroke, forcing out burned gases.

Q. What is the difference between a dry-sump and a wet-sump engine?

A. No lubricating oil remains in the crankcase of a dry-sump engine. With the wet type, all of the oil is carried in the crankcase.

Q. What is the result of spark plugs having too wide a gap?

A. Spark will not jump the gap under compression.

Q. What is compression ratio? Explain.

A. It is the ratio of the total piston displacement to the volume of the clearance space—The higher the compression ratio, the higher the compression pressure and the greater the amount of power developed.

Q. Describe all the ways by which it would be possible to change the mixture in a given carburetor. Name the carburetor.

A. With the Stromberg, the mixture can be changed by the idling adjustment, by changing Venturi and metering set size, the air-bleed, accelerating well and needle valve.

More questions will be answered in Part III, which will appear next month.

END

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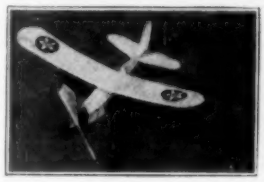

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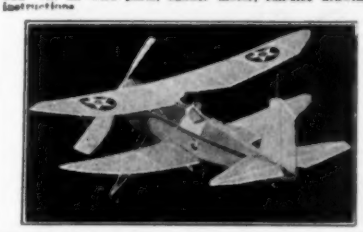
KIT CONTENTS: Jap. tissue, strip blue tissue, printed bal ribs, formers, bal. prop block, spec. bal. nosepiece, tail-block insignia, sandpaper, wheels, bamboo strips, cement, ban oil all wire parts, rubber motor, full-size drawings, instructions.



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Avoiding Accidents

(*Continued from page 358*)

The Department's requirements are somewhat stringent, but not unreasonably so. They are designed to produce, with a maximum of safety, pilots capable of passing the examinations for licenses issued by the Aeronautics Branch. A school, to keep its rating, must maintain a standard of instruction to assure that nine out of ten graduates who apply for license will satisfactorily pass the Department of Commerce tests.

Approved flying schools are rated as (1) private pilot's flying school, (2) limited commercial pilot's flying school and (3) transport pilot's flying school, depending upon the type of license for which its graduates are to apply.

Ground schools are similarly rated. The certificate of approval remains in force for one year. During this period a thorough inspection may be made of the school at any time by the Department of Commerce to insure the maintenance of the required standards.

All planes used for flight instruction must be planes licensed for that purpose by the Department of Commerce. The flying field must be of adequate size, the minimum being one having 2,000 feet of effective landing area in all directions.

The danger of collision is minimized by prohibiting the number of planes engaged in instruction from any field to exceed ten planes per hundred acres at any one time. Thus students are able to give one another a wide berth in taking-off, landing and in maneuvering over the field.

Class-room and ground course facilities are carefully regulated. Construction, maintenance and repair of modern type airplanes and engines, giving the pilot an intimate knowledge of his machine, is required for the higher licenses. A thorough understanding of the Air Commerce Regulations, air traffic rules and of navigation and meteorology is also compulsory.

THE minimum requirements for solo flying, and for dual and check time, insure the student's progress along proper lines.

Instruction in the handling of an airplane entails certain psychological aspects that cannot be passed over lightly. The student flyer presents peculiar problems which must be analyzed and met. The Department recognizes this fact, and in licensing instructors requires that they be able to pass rigid tests. They must not only be thoroughly proficient and experienced in their work, but must possess the ability to impart their knowledge.

One vitally necessary regulation is that pertaining to spin instruction. It requires that all students shall be given instruction in the recovery from stalls and spins prior to first solo.

The number of flying students has increased enormously during the past year. The Department of Commerce has issued 14,267 student permits, a number almost as great as the total number of licensed pilots. Of these students only 400 are receiving instruction in approved schools.

It is time that widespread state legislation was enacted to protect student pilots from the menace of the incompetent operator.

When properly given, flying instructions are no more dangerous than driving an automobile. Therefore, the student in an approved school may look forward with confidence to many happy landings.

END

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1/32x2x36" balsa,	7 for 25c		Hakone tissue — Red,		
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Pioneer Model Airplane Supply Co. :: Champaign, Ill.

National Museum

(*Continued from page* 354)

which made the first east to west crossing of the Atlantic ocean from Baldonnel, Ireland, to Greenely Island off Newfoundland, in charge of Barron von Huenefeld, Capt. Koehl and Col. Fitzmaurice in 1928.

The Langley plane always will remain a source of attraction. This also is suspended from the ceiling, spreading its clumsy wings, reminiscent of batwings, over the heads of the curious. Ungainly and with futile-seeming propellers made of canvas, the Langley plane, nevertheless, demonstrated in 1906 that a heavier-than-air kite could fly.

The Wright plane which the United States Army purchased in 1909 is there. It was the first plane ever bought by any government in the world, the forerunner of the great air armadas of the universe.

Among the gliders are a Lilienthal glider dated 1894; the William H. Martin glider of 1909 and the glider in which Capt. Frank M. Hawks crossed the continent in 1930.

In the building is the hull of the NC-4. Too large to permit the wings to be housed, only the hull, which is as large as one of the ships in which Columbus crossed the ocean in 1492, is there.

The plane in which Capt. St. Clair Street made a 9,000-mile flight from Mitchell Field, Long Island, to Nome, Alaska, and back, is in the exhibit, and the Chicago, the plane in which Capt. L. H. Smith circumnavigated the globe for the first time in 1924, also is shown.

Some fighting planes are there, too, notably a German Fokker captured at Verdun, two days before the Armistice, by Capt. A. H. McLanahan of the 95th Aero squadron. It is battered and patched and camouflaged and decorated with the figure of a kicking mule. A French Spad in which Lieuts. Brook and Jones gained seven air victories is in the collection.

Here we find, also, the original Berliner helicopter and the first Pitcairn Autogiro.

While most of the exhibit relates to heavier-than-air craft, the balloon is not neglected. Relics include original parts of the observation balloons which Prof. T. S. C. Lowe used in the Civil war. There is the basket of the balloon in which Capt. Hawthorne Gray in 1927 made the then world's altitude record of 42,470 feet.

A fragment of patched cloth is from the balloon used for observation purposes by the Confederates in the Civil war. The women of Richmond, Va., contributed their silk dresses to make the bag, which, when finished, resembled an old fashioned crazy quilt. Three different pieces of silk are contained in the fragment in the National Museum.

END

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Stinson Detroiter (a 2 ft. flying model). The following are 15-in. flying models: Fokker D-VIII and Triplane, Nieuport Scout, D. H. Tiger Moth, Sopwith Camel, Albertross D-III, S E 5 Scout, Ansaldo, Boeing P.12 B, Travelair Mystery (Texaco 13) Spad, Stinson City of Chicago. Plans for 15-in. models 10c each, 3 for 25c. Kits come complete with celluloid wheels, colored tissue, insignia, etc.

Dummy Motors, 1½ in. di., 9 cyl., 17c each; 3 in. di., 30c each. Coulings 22c each. Pants 28c pair. Large Pants for 1⅝ in. wheel 28c pair. Small Pants for 1 in. and ¾ in. di. wheel 15c pair. Celluloid Wheels, ¾ in. di., 2 pair 9c; 1 in. di., 7c pr. 1⅜ in. di., 9c pr. 1⅝ in. di., 13c pr. 3¼ in. di., 28c pr.

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Colored dope, 2 oz. can 11c. Special colored dope 1 oz. 13c. Colors: Red, blue, white, cream, black, gold, aluminum, green, brown, oranze, pink, grey, olive drab, purple and yellow.

Celluloid Cement, 2 oz. can, 11c; 1 pt., 75c.

Jap tissue, 3 sheets 7c (red, white, blue, orange, green, brown).

Dope, Acetone, Banana Oil (same price), 2 oz. 7c.

Music Spring Wire No. 4, 5, 6, 8, 10, 12, 14, 16, 18, 10 t. rolls only, 3c each.

Para Rubber: A new fresh stock 1/32 sq., 50 ft. 7c 3/64 flat, 50 ft. 11c; 1/16 flat, 50 ft. 15c; 1/8 flat, 50 ft. 16c; 3/16 flat 50 ft. 20c.

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3/32 x 2	4 for 9c	1/8 x 1/4	16 for 12c
1/8 x 2	4 for 13c	1/4 x 1/2	1 for 2c
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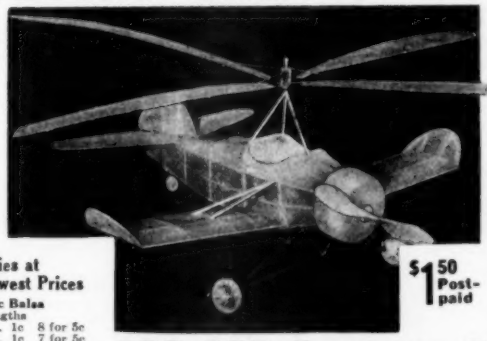

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Hundreds of boys all over the country are now building this Autogiro. A perfect flying scale model at a popular price, which is guaranteed to fly when properly constructed from our copyrighted plans. Will fly from 200 to 500 feet. Rotors are NOT powered, but work the same as the original Autogiro, rotating while flying. Complete kit includes full size plans and instructions, with all ribs, wing tips, bulk heads, etc., stamped on sheet balsa, and everything else required to make a complete flying Autogiro.

Model Supplies at World's Lowest Prices

Scientific Balsa
36" lengths

1/16 x 1/16	1c	8 for 5c	
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3/32 x 3/32	1c	6 for 5c	
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Sheet Balsa
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1/32 x 2	4c	1/16 x 3	9c
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3/8 x 1/2 x 5	1c
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Large 2 oz. can 10c

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The famous plane used by Livingston and Omlie in the National Air Race victories. The most complete kit offered today. Contains everything to make a complete Gee Bee flying model, including full size plans and all parts clearly printed on balsa.

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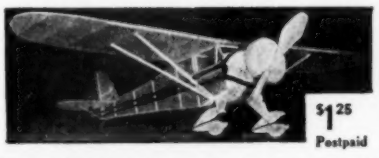

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15" FLYING SCALE MODELS

Complete in every detail, including full size working drawings and detailed instructions. Easy to build and guaranteed to fly. **99c Each Kit Postpaid**

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WORLD'S LARGEST MANUFACTURER OF MODEL AIRPLANE KITS AND SUPPLIES EXCLUSIVELY.

Amateur Aviation

(*Continued from page* 362)

go ahead and become familiar with aviation, in their own way, they would become the buyers, engineers, and manufacturers of tomorrow. Further than that, they would become the very backbone of the next war in the air. No matter how you look at it, the country is bound to lose under the present conditions.

There are two ways in which this matter could be made satisfactory to all. The simplest would be for the Department of Commerce to establish a special class license, covering this type plane. It could limit the horse power to fifty, the wing loading to four or four and a half pounds per square foot and demand that all such ships be for pilots only. When finished it could be given a static and flight test by an inspector and licensed for flight from private fields only. Pilots, of course, must have a license. This is certainly not asking very much.

If this is out of the question, and it probably is, the separate states should make a similar regulation. The so-called "Oregon System" could well serve as a pattern for all. Under this system all commercial flying must meet Federal regulations. Private flying is under control of the State Board of Aeronautics. If an individual builds an airplane he simply notifies the state.

It might be interesting to know that during the past several years there has been but one fatal accident due to a light plane crash. This simply proves that anyone with sense enough to obtain a pilot's license, and to design and build an airplane, has sense enough to value his own neck. We must all work together if every state is to have an "Oregon System", or one similar to it.

END

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Steam Turbines

(*Continued from page* 372)

running at 10,000 R.P.M., it is not likely that the gyrostatic force would be much more than twice that of a nine-foot propeller turning at 1,600 R.P.M. If such would be the case in practice, then it could be easily disposed of by placing the rotor in opposition to the propeller to which it is connected.

In respect to the matter of vibration, there can be no argument against the superior running qualities of a turbine with only a single rotating part. There are no reciprocating parts to cause endless complicated harmonics, and once in balance, the rotor always remains in balance under all operating conditions, which is far from being the case with a reciprocating type. Vibration is banished, and, together with it, noises disappear. There is no noise from the exhaust nor is there propeller "flutter" due to the pounding of pistons and similar variations in the driving torque.

It is of interest and importance to note the increased efficiency due to torque uniformity. With reciprocating engines of any type, either steam or gasoline, the application of power to the crankshaft is intermittent and there are pronounced pulsations during each revolution. This is true even with the degree of "overlap" afforded by increasing the number of cylinders to eight or twelve. During each momentary speed decrease and increase, there is a loss of driving torque which in turn means that there is a loss of propeller efficiency.

The torque of the steam turbine, being absolutely free from pulsations, improves the overall performance by just this amount. In the same way, the propeller and its hub are freed from the stresses induced by the steady hammering of the pistons, and again this is a safety measure of no small proportion.

As pointed out in a former article on steam engines, it is possible to burn any class of fuel under a steam boiler. In fact, cheap oils that are too heavy and viscuous to burn in the cylinders of a Diesel engine are very easily burned in a steam boiler. Again, oils and tars that cannot be ignited in the open air with a match are easily burned in the furnace of a steam boiler, and once more we have a safety factor in favor of the steam plant.

END

Build Three Famous Pursuit Ships!

Here are the most complete Kits on the market to build the famous SOPWITH CAMEL (above), NIEUPORT SCOUT, Wing span—13¼ inches, and the FOKKER D-7, wing span—15 inches. They are all in perfect proportion with each other. Kits contain stamped parts, wire parts, easy-to-make props, insignia, full-size plans, etc. All very excellent fliers, none better.

COMPLETE KIT FOR SOPWITH CAMEL OR NIEUPORT—$1.25 POST-PAID
CAMEL OR NIEUPORT PLANS—25c EACH
COMPLETE KIT FOR FOKKER D-7—ONLY $1.50 POST-PAID
FOKKER D-7 PLANS—30c
ALL THREE KITS PACKED TOGETHER—$3.50

FREE!—With all orders for Kits until June 30 we will give a free full-size plan for a flying-scale model of a famous ship, such as GEE-BEE, LAIRD SUPER-SOLUTION, etc. Cut out this ad and mail with your order for free plan.

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SEND 5c COIN FOR ILLUSTRATED PRICE LIST

SKI-HI MODEL AIRCRAFTERS
Sunrise Gardens, Lynbrook, L. I., N. Y.

Target Practice

(*Continued from page* 370)

But we are talking about the front cover. Notice the target, in the midst of the exploding shells. It is a large wind sock from twelve to fifteen feet long. Our artist tried to show it more as it really appears when the shells are bursting, but the idea did not work. There would not have been enough of the target left to identify.

Some of our readers will be thinking that the pilot in the towing ship is "on the spot". He is in very little danger, for the towing cable is over a thousand feet long. The exploding area around the target is only about five hundred feet in diameter, so the pilot is practically safe. When practice work first begun, however, the cable had to be a good deal longer.

Dodging, twisting, diving, zooming, the wind-sock target imitates the movements of an enemy plane.

END

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Miniature *Replica* Models

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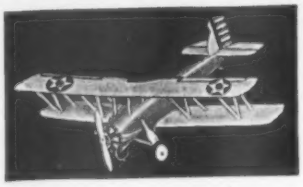
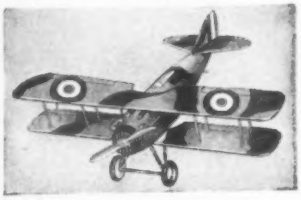


Curtiss Fledgeling

Pitcairn AutoGiro



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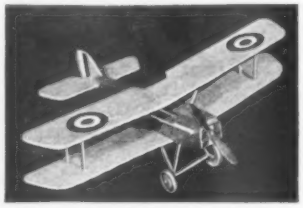

British S. E. 5

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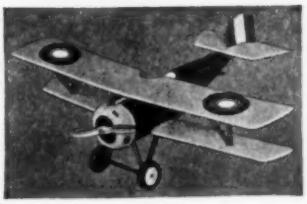

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GeeBee Sportster

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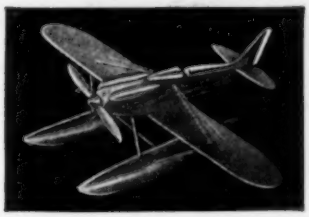
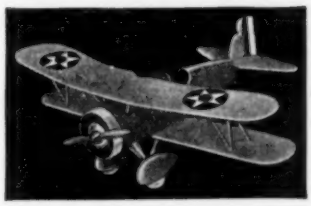
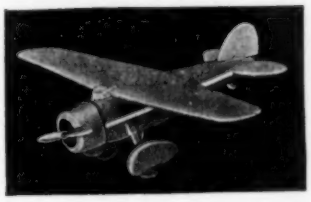


Napier SuperMarine

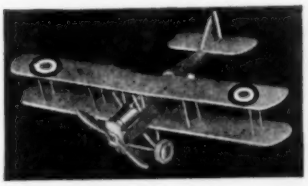


Curtiss Hell Diver



Lockheed Vega

Curtiss Hawk P6-E



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Comeback of Jerry Donahue

(*Continued from page 374*)

about eight hundred. The ship quivered, then whipped over and plunged down along the line of its ascent. With bated breath we awaited the crash.

THERE was no crash. Just above the grass, Jerry leveled her off and began climbing. Sighs of relief were premature, however, for the next number on the program would have been a series of wingovers had a sane pilot been at the controls. In this case they were vertical side-slips, one wing straight up, then a sickening dip and the other one raised—then repeat.

Suddenly, Jerry sent the ship hurtling toward us in the steepest kind of power dive, apparently intending to bury the engine in the ground. But no! He leveled off with a fair margin, bellied the stick and tried a loop. It failed flat at the top and the next maneuver looked like an Immelmann turn. It failed also, and she went into a spin. It looked like the end, but Jerry righted his ship in some occult fashion, coming out of it upside down.

In this position he made a complete and perfect bank, but in trying to right the plane, he started what resembled an outside loop. He made about half of it. Then, to our intense relief, he seemed to get entire control and leveled off for straight flight.

By this time, the other flyers were circling around him like a flock of angry birds. I went aloft and signalled them into formation, hoping to lure Jerry down with us.

The trick worked. Flying in a perfect V, with three ships ahead, Jerry stayed in line like a veteran—and to my utter amazement—made a perfect landing.

BUT after he taxied to a neat stop on the line, Jerry remained in the cockpit as though in a trance while we helped a hysterical girl and her very sick escort to the ground. We went after him then with a storm of abuse, but the man who answered us was not the half-witted Jerry we knew. He insisted that he was a transport pilot and that he remembered nothing of the Oldham Airport until he found himself flying in formation with us.

And so it turned out. He had done most of his flying in South America and had returned to the States for a vacation. Then he must have received a head injury in some kind of accident that caused him to forget everything except his name and a vague feeling that he should be able to fly. The bump he got in the parachute drop must have started restoration of his normal thought processes and the wild stunts he had performed were flashes from his flying experience.

Jerry (of course that is not his real name) is still flying and is rated one of the best in the business.

END

Hailstones

(*Continued from page 350*)

only 10 to 15 minutes in one place. Why these spectacular storms attack only strips of country less than a mile wide and about 200 miles long, traveling at a speed of from 20 to 25 miles an hour, science has failed to fathom during centuries of research. Just another one of those secrets of nature which have defied solution.

Fantastic tales have been told of gargantuan hailstones, some as large as the mouth of a hogshead, others rivaling the proportions of a 6-foot pushball. Masses of molten ice—the visible remains of the fleeting storm—have unquestionably been found, but, without exception, they have been amalgamations of many hail stones instead of individual specimens.

The U. S. Weather Bureau reports the record hail stones, in meteorological history, as ranging from 5 to 6 inches in diameter. When you hear these fantastic stories about hailstones "as big as elephants", you can catalogue them forthwith as pure spun fiction.

Hail is formed when the turbulent uprushing air, racing at airplane speed towards upper cloudland, carries drops of water to altitudes where they freeze. A strange game of "up and down" then ensues. The fluctuating air currents allow the congealed drops to fall to elevations where more water is deposited over them. Then they are shot up again in the violent air stream to the latitude of snow and icicles. While this phenomenon continues, the hail stone grows in size, being made up of alternations of snow and frozen water.

When the uprush of air by convection ceases, due to the diminution in temperature contrast, the hail stones, which are heavier than the supporting air, catapult to earth, destroying crops, shredding ornamental foliage, breaking window glass and skylights, and generally causing costly damage.

In the spring and early summer, in the latitude of Washington, D. C., and with normal earth temperature about 70°F., atmospheric moisture has to be elevated to a point 1½ miles above the ground in order to freeze and form hail. Under midsummer conditions, the water drops would have to be blown as high as two miles up in order to form hail.

Hail is unknown in the tropical and semitropical regions because the moisture would have to be elevated to such high altitudes in order to freeze that the hail stones would subsequently melt before they could reach the ground in their long trip from the empire of the clouds.

Pilots should not intentionally fly toward thunderstorms. The danger of hail is too great. Even fog is not as dangerous as is hail. The former, of course, will blind the pilot but will not necessarily injure him nor the ship.

Hail, on the other hand, falling with the speed of a bullet can ruin a ship. It riddles the fabric, stripping it from the wings in streamers, and plywood is little better. The propellers take even more punishment. A wooden prop will quickly splinter and fly to pieces, while a metal blade will be so badly bent as to need replacement.

It is not uncommon for the control wires to be broken, especially if they are under extra strain or have a weak spot. These failures combined, or even singly, are sure to bring the plane down to earth, possibly out of control.

END

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Purcell

(*Continued from page 364*)

A rather well known Pacific Coast pilot was bringing a Robin into a Northern California port one evening last year. This was a strange port to the pilot and from the air he put the O. K. on the field and started in. Yeah Bo. This same pilot must have taken a short nap between the time he cut the gun for the landing and the time he "landed". The Robin had an old O X power plant on the nose. As the wires loomed up ahead of him, he grabbed the throttle and tried to pour it to her, but the O X said, "I ain't a-gunna do it," and conked out, leaving Mr. Pilot in a tough spot.

As I said before, Mr. Pilot was an old timer and knew the landing speed of a Robin like nobody's business. He knew he just had one chance and that was to sit down on top of the wires. Clearing them was impossible at that speed. With the aid of a little "fish tailing" he put her down on the power lines, about six of them. Well, there he was, about one hundred feet in the air and between two big power towers. He afterwards said that he would have tried to walk the wires up to one of the poles but he couldn't remember whether or not these big high voltage wires were fully insulated. They were about two inches thick and were built to carry plenty of voltage.

THE field men of the field in which he tried to land, ran over to him and offered him several different kinds of advice as to how he could get down. The old Robin looked like it was going to stay there for the next few years. It settled right down onto the wires like an old hen on its chicks. Every time it settled the pilot got fixed to bail out on the wires, let come what may.

Finally the local fire department got the pilot on the ground. Now can some of you Bimbos imagine making a "landing" via a ladder. Hot dog! I don't blame this pee-lot for not wanting this story told. We understand the poor devil is having a tough job trying to live this little incident down. Among his Christmas presents were several miniature ladders and a fireman's hat.

He is now working for a passenger run and once in a while the airport attendant runs up to his ship with a ladder, as he brings his trimotor up to the passenger landing, and offers to help him out of the control cabin window.

Human life is something that should not be held cheaply and some of our large public utilities corporations will have to get that fact rammed into their dumb heads. Passengers in airplanes should not be asked to jeopardize their lives while flying. We all know that if a ship crashes into some of these obstructions the airplane will be at fault, not the wires. Aviation is having a tough enough time to make the grade without having a lot of unnecessary difficulties in the way.

An old timer can bat along and duck these contraptions of the devil but the coming generation in this man's game will lack this experience. They may be like the prize fighter who forgot to duck, but the consequences will be a lot worse in their cases. It won't be long now until the passengers of air lines will rise up in a body and demand that these things be removed.

If your local airport is having this trouble, call the gang together and start to work on the necessary officials. As suggested above, you might offer them a free ride, and if you ever get them into a plane, take them as near the wires as it is safe to do. This will be much too close for a non-flyer, and when you get him down on the ground you'll have no trouble convincing him that the wires or other obstructions should be removed.

Some of our legislators do not realize the difficulties experienced by a pilot when he has these things to contend with. The only way to make them realize is to "put them on the spot". If you ever have this opportunity, don't be easy with the "politician" but don't be too hard with him. Just go as close to the obstruction as you consider safe. A layman doesn't realize how near is "safe" and if those

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wires come within one hundred feet of him it will be a lot too close for his comfort. One hundred feet will give him skithers, jitters and nervous chills, and if you're a good smart pee-lot you'll have a couple of newspaper men there to publish his statements about the obstructions when he gets back on the ground. This will insure his statements, and when he has again become rational he will find it rather difficult to back down from them. Especially when the "public utilities" start to kick.

If someone can ever get airport supers together, without having a "nasty-nice" meeting, (these Bimbos usually shake each other's hands when they meet, and "cat" like old ladies when they part), a proposition could be submitted to the federal government to put an end to these aids to an undertaker's pocketbook.

It is a well known fact that thousands of pilots are yelling to have these things removed from the vicinity of airports. It is also a well known fact that matters go no farther. "Yells" are as far as this matter goes. Aviation organizations seem to have an extra large amount of lead in their extremities but these same organizations will have to wake up to the fact that—

"The Lord helps those who help themselves."

END

Material Fatigue

(*Continued from page* 360)

one thought but that it was sufficiently strong to be perfectly safe.

Then one day as the plane was being landed, the landing gear gave 'way, and dropped the plane to the ground in what might have been a serious accident.

The jars on the strut during landings and take offs had brought about a typical fatigue failure at the point of the nick. From the end view of the strut as shown, the structure of the break can be seen. Starting at the dent a crack formed which spread, and finally failed, leaving the crystal structure at the point of the final failure untouched by rubbing of the ends of the metal.

Streamline wire fatigue failures also occur. It may seem that a nick caused by the little amounts of rust that form on a streamline wire may not be large enough to weaken the where stresses are concentrated, and in the rapid vibration that sometimes occurs in streamline wires, the stresses at this point may finally exceed the elastic limit of the material; then exceed the ultimate strength, and a crack develops.

If it were not for the effect of reversed stresses, and vibration, a nick or rust spot would not weaken the structure enough to be noticed.

Since the strength of a material in straight tension may not be a test of its strength in fatigue failure, special testing procedure has been developed. Below a certain application of load, fatigue failure will never occur regardless of how many reversals of load the material is given. Beyond a certain load, fatigue failure will occur depending upon the number of reversals of stress given.

Compared to their strengths in tension, nickel alloy steels are among the highest materials in resistance to fatigue failure, and duralumin is among the lowest.

It is a wise rule where members are subject to rapid reverse loads, never to put a member in service if there are nicks present. The author hopes this brief account may have served to explain the nature of failures in metal.

END

Fastest Transport

(*Continued from page* 365)

gagement in Chicago, as immaculate as when he stepped into the plane.

Pittsburgh seems to spread out in every direction, as far as one can see. It is truly and rightfully named the "Smoky City". There is a heavy dark smoke pall that seems to hang over the entire town. Off ahead, and to the right, the tall buildings of the downtown section can be made out, grouped together down in the valley of the Ohio River.

The plane is banking slightly and there is the airport on what appears to be the top of a hill or mountain. It seems rather short for comfort from the air and looks like it might be easily overshot. To overshoot would indeed be serious business here, for the plane would go tumbling down the mountainside.

But the pilot on this trip is L. H. Steward of Chicago, who learned to fly during the World War and has been at it ever since, with many thousands of hours of both day and night flying. He handles his ship like the veteran he is. As we circle the field preparatory to landing, I feel the keen responsibility that is his to bring us down safely.

He is working a lever, the size of an automobile gear shift, back and forth which I later learned was the hydraulic device that lowers and raises our landing gear. The landing gear folds inwardly and fits snugly into a recessed area in the under part of the wings. When in flight, the speed of the plane is increased approximately 35 miles per hour by folding up this birdlike device.

As we start the glide, he gave the stabilizer control handle a few extra turns, and, as the ground rushes by, we feel the tail-skid touch and know we are once more on good old "Mother Earth." As we cannot see straight ahead, we are a bit worried for the moment as the plane continues to roll fairly fast, remembering the apparent shortness of the field from aloft.

But we are unduly alarmed, for our

(*Continued on next page*)

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(*Continued from preceding page*)

able pilot immediately applies his brakes and we come to a stop on a designated line and in front of a fine modern airport building.

A glance at my watch tells me it is 5:29 p. m., or one hour and fourteen minutes since we left Washington. There is speed for you. All the spectators leave a tri-motored ship to hurry over and see our more interesting plane. Veteran pilots are outspoken in their praise of the beauty and graceful lines of this particular type of ship, both on the ground where her streamlining is more easily appreciated, and in the air where she is truly graceful with her wheels drawn up.

As we climb out for a smoke, we say farewell to three of our fellow passengers, and upon climbing back in again, make the acquaintance of three new aerial travelers bound for our destination—Chicago—so we are again six all. A uniformed attendant handed some weather data to our pilot and we start down the runway to the other end of the field for the take-off into the wind. I notice Steward takes the ship as far down as he possibly can. In fact, we have gone so far, that, as he swings her around, sets his brakes, turns up his engine and checks his instruments, the ground ahead for fifty feet slopes gently upward.

At our back, the mountain's slope falls away into a deep valley. There is a roar, and as the brakes are released, we start to move slowly forward. Then we gather speed, faster and faster until the tail-skid stops its grinding noise as it is lifted up. The earth starts to fall away gradually and all objects seem to shrink in size as we are once again on our way.

Canton, Ohio, which is about 100 miles to the westward, is our next and last stop before reaching Chicago. The wind is from the northeast, almost on our tail. We can tell its direction by watching smoke as it curls its way upward out of factory chimneys. We pass over another airport in the making, which appears much larger than the one we just left. Its runways look like asphalt and should be a credit to Pittsburgh when completed.

As Steward is turning the stabilizer control lever, one of our new passengers—a 250 pounder—points out the Ohio River on our right which later winds its way beneath us. The surrounding country as far as the eye can see, which is about 15 miles, is hilly, and with no area that seems inviting enough or large enough to land on.

At the request of one of the passengers I handed Steward a note, asking him the name of a small town we were just about to pass over, and incidentally, what our approximate ground speed was. To the first question his humorous reply was, "I could lie but my honest nature prevents," and to the second, "About 215 miles per hour." As the message was passed around, each one in turn looked at the ground, which at this time was about 2000 feet below us.

We have flown from Pittsburgh to Canton in 25 minutes. Our average speed between the two towns including circling the field and landing was an even 200 miles per hour. The attendants here seem unusually friendly and courteous, and while they are filling our gas devouring steed with aviation ethyl, we all clamber out for a smoke.

* * *

GARY was passed, Whiting and its tank farms and oil refineries was reached in another 2 min.

And now we are gazing on a sight to behold. Countless millions of lights set out in squares and a solid mass of lights appears that is undoubtedly some busy intersection of Chicago. Well, I wonder why the bumps all of a sudden. These are the first real bumps we have experienced during the entire trip. It suddenly dawns on me, however, that we are over the "Windy City". Again, the wind that has been boosting us along since we left Pittsburgh was a northeaster and as we round the lake we get the full force of it right off the water.

We shoot over a large gas tank at about 1,000 feet. It has a lot of red and white lights on it as a warning to airmen to keep away, and also a large arrow painted completely across its top pointing to the Chicago Municipal Airport. As we peer ahead, we can see the steel-blue floodlights of the field that have been turned on in anticipation of our arrival. As we approach it, and then circle it, the cinder runways are easily made out—each lined with small lights.

It indicated 3 hours and 59 minutes total elapsed time leaving Washington, D. C., and deducting the 11 minutes spent on the ground at Pittsburgh, and another 12 minutes at Canton taking on gas—a total of 23 minutes. Our flying time was 3 hours and 36 minutes.

It will probably be considered slow time in another 10 years, but the thought alone of coming so far in a fraction less than 4 hours was thrilling in itself. Speed, however, is the goal that must obviously be reached by the aircraft industry if they wish to attain future success. The safety factors involved in flying either 100 or 200 miles per hour are no different—if we are to take the word of our pilot. The landing and take-off speeds are a little faster, but with the modern airports that item is negligible.

END

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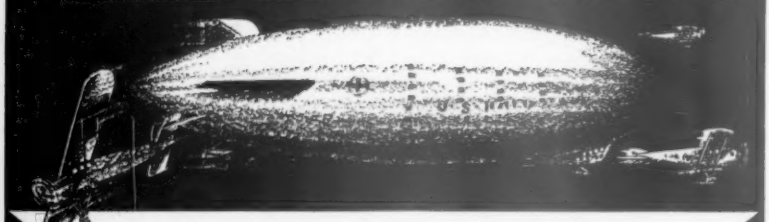

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TRI-STATE COLLEGE

Airy Chat

(*Continued from page* 346)

acting as a separate organization from either military department. There will be no such thing as state laws, for Section 7 provides: "Immediately upon the signing of this act by the President, all states and commonwealths comprising the United States shall diseard any and all laws they may have in operation, pertaining to aeronautics and in the future shall cooperate with the Federal Department of Aeronautics."

Well, fellows, what do you think of this proposal? It would be mighty interesting to have a few letters from you on this subject. Our policy has always been, "Let the legislators keep their hands off civil aviation", and we fail to see why or where this bill offers any drastic improvement in this respect. Knocking out the state interference is O.K. with us, but in the long run, does interference from the Federal Government improve matters?

* * *

AND now, fellows, I am the bearer of great and good news for many of you. A dealer recently made a wonderful offer to us, and we pass this opportunity on to you. It is a chance to purchase a brand new Eastman flying boat for the exceedingly low price of $3,000, complete and ready to fly! We supply the flying boat without a cent of profit—you get it for exactly what it costs us.

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If you are really interested in purchasing a ship of this class, write us for full particulars and specifications. The name of the auctioneer who offered us this bargain will be supplied upon request. It will be well worth your time.

* * *

POPULAR AVIATION trusts that it has inspired many of its readers to conduct experimental and research work, and therefore this letter that we received from Al Strobel has been of greatest interest to us. Read what Mr. Strobel has to say about his experiment.

From time to time, I have read in your magazine paragraphs discussing the use of a rotor as a supporting factor on an airplane. Fascinated, I designed, built and tested first a wind tunnel model and later actual flying models.

In absolutely still air, a model falls at the rate of 18 inches per second, and at an angle of 25 degrees with the horizon, or in other words, at a gliding angle of about one to two.

In a gentle breeze, it rockets up like an elevator to about fifteen or twenty feet and then slowly descends until the power quits which causes it to fall like so many sticks.

My models being for experimental purposes were necessarily heavy and unrefined. But equip one with propellers, decrease the weight and increase the aspect ratio and someone's sure to be surprised. I am sorry I don't have the time nor the means for elaborate research work.

It sounds great. With a few more pushing and pulling on this rotor business, maybe we will get somewhere with it. Just as a suggestion, why not have the rotors propelled by the air stream like the rotors of an Autogiro, so as to eliminate the sudden descent when the engine stops?

* * *

POPULAR AVIATION will sell certain of the original photographs appearing in its pages at $1.00 each. A few will be kept for our files. All the rest are available at this remarkable offer.

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Please give date of issue, page number and caption of the picture. Illustrations from back issues are available under the same conditions.

* * *

JOHN WILEY & SONS, INC., 440 Fourth Ave., New York City, have recently brought out two new books on aviation. The first is a practical book, *"Principles and Problems of Aircraft Engines"*, by Minor M. Farleigh. This is purely a book of practice on handling aviation engines, priced at $3.00. The second book, *"Dynamics of Airplanes and Airplane Structures"*, is a simplified engineering book useful to aeronautical engineers. It lists at $3.50.

* * *

AMOS J. WOOD, 14624 Armin Ave., Lakewood, Ohio, writes in about his glider.

Recently, I had an opportunity to buy a half-finished secondary glider at a dirt-cheap price. However, the rub is that there aren't any plans with it. Would you aid me in obtaining a set by printing a note in "Airy Chat"?

The glider is supposed to be called the "Sea Gull" and was manufactured by a group of individuals living somewhere in California. It has a 40 ft. wing spread with tapered wing tips, and is of all wood construction.

Originally, the wings were supposed to be held on by wires with a cabane on top. The spars are of cantilever construction, and the airfoil is a Gottengin 441. The ship as a whole has lines of a German soarer. It was supposed to have been quite popular two years ago.

This is all that I know about it, but I would be very glad to get in touch with anyone who knows anything about this ship.

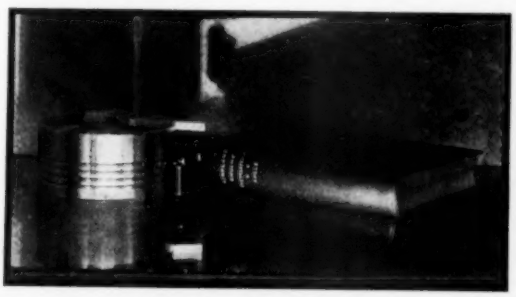
Well, I hope that you locate the blue-prints. It's a cinch that some of our readers must have a set concealed about them somewhere—maybe two sets.

* * *

And just before I close, I wish to remind a few members of the family that "Orion" is not pronounced "Oryon," but is Irish in nature and rhymes with O'Brien.

J. B. R.

Here's a Graduation Gift to be Proud Of



On the left you'll see a picture of a fine aluminum alloy ash tray. This highly polished metal tray will last forever, never rusts or tarnishes, and it makes a splendid gift for your pilot friends and aviation fans. Made from Hispano - Suiza pistons out of engines just like those used by famous Aces during the World War. Sent postpaid anywhere in the United States for **$1.98**

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This book used to cost $7.50. My price is now $2.98, postpaid anywhere in the United States, while they last.

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NEIL C. TASKER, Shamokin, Penn.

Q. & A.

(*Continued from page* 378)

horsepower acting on the shaft or propeller, the torque decreases with an increasing speed.

* * *

QUESTION:—Albert Jarkov, Pittsburgh, Pa. *Why do fast planes have small or short wings while the slower planes have much larger wings in proportion? Is this to reduce the air resistance?*

ANSWER:—AT HIGH speed, the lift on each square foot of wing surface is very much higher than at low speed. Since the wing lift must be equal to the weight of the plane in all cases, it is evident that less wing area will be required at high speed where each square foot of the surface is more effective in producing a lifting effect.

The area is the "projected area" as represented by the shadow of the wing—not the surface.

In general, the lift per square foot varies as the "square" of the speed. That is, doubling the speed increases the lift four times. Increasing the speed to three times its original value increases the lift: $3 \times 3 = 9$ times. It will be seen that the lift increases very rapidly with each increase in speed, hence small wings are most desirable for racers while large area wings must be used at low speed. An ordinary plane having a moderate speed is loaded from 8.0 to 9.0 pounds per square foot of wing surface, while the Supermarine racer is loaded above 40 pounds per square foot for speeds slightly above 400 m.p.h.

* * *

QUESTION:—Fred Buck, Memphis, Tenn. *Will wings lift when they are covered only on one side, say when the top surface is covered with the ribs and spars in the open on the lower side?*

ANSWER:—MANY of the early planes were of the single surfaced type, notably, the early Curtiss "tripods" and the early Farmans. These ships flew, but they were not very efficient, owing to the breaking of the airstream by the exposed ribs and spars. We do not recommend this practice except for purely experimental planes, and to accomplish anything at all, the spars must be very thin so that they disturb the air as little as possible.

* * *

QUESTION:—Louis Faust, Omaha, Neb. *Is silk a suitable covering for airplane wings and could it be used if it were not so expensive?*

ANSWER:—NO. IT is rapidly destroyed by the ultra-violet rays of the sun, and soon cracks when exposed to the weather. It is light and strong when new, but it soon loses these qualities in the open air.

* * *

QUESTION:—*Do you believe that an engine can be made powerful enough and light enough to lift a helicopter? Has a helicopter ever lifted itself off the ground?*

ANSWER:—A NUMBER of helicopters have lifted themselves off the ground, but lift or lack of lift is not the main trouble. The principal difficulty is the lack of stability in even a light breeze, an instability that rapidly becomes worse when the strength of the breeze increases.

When a horizontal breeze is blowing, the advancing blade of the lifting propeller meets the air faster than the retreating blade on the other side. The result is that the first blade has a greater lift than the latter, and that the ship is quickly canted over on one side. This is overcome in the Autogiro by the use of specially hinged blades that equalize the lift.

* * *

QUESTION:—Anton Bezak, Boston, Mass. *I understand that there is a quick method of converting miles per hour into feet per minute. What is this rule?*

ANSWER:—TO FIND the speed in feet per minute, multiply the m.p.h. by 88. Thus, if the speed is known to be 50 m.p.h., then the speed in feet per minute $= 88 \times 50 = 4{,}400$ feet per minute. To find the speed in feet per second, divide the feet per minute by 60. Thus, in the above example, dividing 4,400 by 60 = 73.3 feet per second.

END

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Write or wire for reservation.

LEONARD HICKS
Managing Director

Bombardment Group
(*Continued from page* 380)

up, down, or either side that the hostile aircraft may come in from. The Condor carry machine guns in the nose and in the right and left "nacelles". Each gun mount is capable of about 1,000 rounds per minute. The Keystones carry the same flexible twin Brownings, distributed as follows: One in the nose, one in a gunner's cockpit located in the rear of the fuselage, and one mounted so as to fire through a hole or "tunnel" in the floor of the fuselage.

The baseing of both Pursuit and Bombardment at this field gives both Groups training in rendezvous problems. An objective will be designated for destruction by bombardment (a railroad yard, a harbor or an industrial center). The slower bombers will depart at a given hour and rendezvous 200 miles away with the speedier pursuit, who depart after the bombers and will proceed with them a short distance to the scene of the objective. They will hover over the bombardment ready to attack and destroy any hostile aircraft attempting to interfere with the bombarders in the performance of their mission.

The planes will return in the same way, except that the protecting planes will remain to guard the bombers against any revengeful attack. When all danger is over, the fast planes will line out for home allowing the bombers to come in at their leisure.

DEVELOPMENTS in radio have not been overlooked by the Air Corps. Communications sections are under the supervision of officers who have received intensive training, both practical and theoretical in this line. In the majority of cases their enlisted assistants are graduates of the Radio and Communications course of the Air Corps Technical School at Chanute Field, Rantoul, Illinois.

All bombardment planes are equipped with both transmitting and receiving sets. When the Bombardment Group take the air, the Group Commander issues orders to and receives orders from the Squadron Commanders through the radio operators in the Squadron Commander's ships. The Group Commander is usually in his "flying office" in the Command Ship issuing orders. Although the Squadron Commanders are generally at the controls of their ships, transmission of orders between the radio operator in the fuselage or out on the "nacelle" is made simple by means of an intra-phone system in each bomber.

When the Pursuit Group takes to its wings only Group, Squadron, and Flight Commanders have receiving and transmitting sets. All of the ships, however, have receiving sets. Orders are relayed through about the same net as in bombardment, with only a few limitations. One of the factors that pursuit has striven for years to overcome is the matter of excess weight in radio sets.

A big stride to the fore in this connection was recently made when a successful transmitting and receiving set weighing only *40 pounds*, as against 100 pounds of the former set, was manufactured and installed in Air Corps pursuit ships. It is well known that the success of a pursuit pilot lays in his ability to travel at high speed and anything tending to cut down speed is frowned upon.

The 1931 Air Corps Maneuvers witnessed the mobilization of 675 airplanes and about 1,500 officers and enlisted men of the Air Corps—by far the largest centralization of Uncle Sam's aerial forces yet attempted. The object of those maneuvers was to work out, practically, the solution of problems of supply, transportation and tactics with which the Air Corps would be faced in case of hostilities.

A unit of this force made demonstration flights over Chicago, New York, Boston and other large cities of the East and Middle West.

It is worthy of note that the three squadrons in the Demonstration Unit were chosen for the excellence of their past and current performances in all phases of military aviation and that two of the three demonstration squadrons, namely the 11th Bombardment Squadron and the 95th Pursuit Squadron, are at this time members of the FIRST BOMBARDMENT WING.

END

Johnny Starr
(*Continues from page* 356)

Oakland, Nebraska, where he had spotted the depot, and this town happens to be 30 miles northwest of Omaha.

In his own words, Johnny "had a hell of a time" getting out of that stubble field.

AS early as August he began finding zero weather above Omaha. Today, as this is written, it is 9 below zero on the ground at Omaha—Johnny found 48.6 below zero at 17,000 feet. He was compelled to add a slightly personal note to his official report of altitude, temperature, humidity and such. He wrote on the report: "Boy, it was colder than H——!" He grinned when questioned about his experience and then drove home in his heavy flying togs. Always before he had left them at the hangar.

Starr during the winter has dressed as warmly as convenience would permit. Over his ordinary clothes he wears a fleece lined vest, a heavy jacket and then his fur lined, electrically heated flying suit. He hasn't used the latter convenience, however. His hands are protected with huge gloves, fur-lined, and over his face he wears a soft chamois mask with holes for the eyes, nose and mouth. His helmet and goggles are strapped firmly over that.

His hands and feet suffer most from the cold, but he cannot dress them more warmly, as they would become too awkward for handling the ship. As it is, Starr often has trouble locating the ground when he comes down from his dizzy heights.

One night Johnny flew "blind" all

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A group of Pietenpol light planes. The ship at the left is powered with a Ford "T" motor. A Velie motor is installed in center ship, while a Ford "A" motor is used at the right.

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Photograph showing 19 views of ship, motor conversion and construction of ship. Also specifications and price list $1.00

B. H. PIETENPOL - Spring Valley, Minn.

the way up. At 20,700 feet ice began to form on his wings, and a little ice goes a long way toward making a flier uncomfortable at that or any other altitude. He knew the weather bureau boys on the ground would want to know all about that ice, so he unbuckled his safety belt and stood up in the open cockpit so he could test the coating on his windshield with his finger. As he did so, the plane dropped off into a spin and almost simultaneously the main gas tank went dry. Down went Starr and the Sparton, whistling through space, twisting, turning through clouds that forbade him seeing anything but the tips of his wings. Only the instruments to depend on and half of them were frozen stiff! Hurtling through foggy, directionless space.

The plane spun down about 4,000 feet before Johnny could switch to his reserve gas tank and the engine take hold again. There the ice melted sufficiently for him to straighten out. In his radio earphones he heard the ground operator bark that the fog had completely closed in at the airport and that visibility was now zero-zero, which means if you can see your dashboard in the stuff you're lucky. Johnny looked longingly at the ring of his parachute and started down.

He "felt" his way as best he could and at 500 feet found himself flirting with the tops of Omaha's downtown buildings. Occasionally, through a hole, he could see one poking its nose up at him. He hit for the river, hoping he could trace it upstream to the airport, but nothing doing. His gas was getting low and he nosed the Sparton up once or twice, prepared to step out, only to see another hole which beckoned him on. Folks down on the streets that night must have thought that fellow in the airplane up there was having a grand time zooming about, but ask Johnny. Says he:

"FRANKLY, I was scared. I hated to jump and I hated to stick it out, but suddenly I saw a hole ahead which seemed to go clear to the ground. I headed for it like a scared rabbit and down low I saw a beacon light.

"I circled the thing, trying to get the lay of the land about it and by the glow of the light could make out that a farm house was sitting in one corner of the field. To this day I don't know how I ever got down, but I did. The field was about 350 feet long and high tension wires running across one end of it. The wind was right, otherwise I would have cut right through those wires, coming in. Wow, what a feeling, now that it's all over, but I'll wager right now, in good daylight and with the wind ideal, I can't get into that field twice in ten times! How I did it that night I'll never know. As it was, I stopped just about 10 feet from the fence."

Johnny said that at 24,000 feet Omaha looks about as big as a postage stamp and when visibility is good, at that height, he can see as far away as Des Moines and Grand Island—each about 150 miles distant!

Strange as it would seem, Starr's bride would like to go on one of those 4 a. m. flights with him. They were married three days before Starr began his weather flights.

"Mrs. Lindbergh learned to fly and I'm going to do the same thing," she insists.

"All right," drawled Johnny, who often lets her take one of the dual controls on other flights, "but not at 4 a. m."

END

Combat Methods

(*Continued from page* 350)

and maneuvered to trap Madon coming out of a spiral.

The Frenchman was quick to see the impending disaster of a collision. He banked steeply, came around with the speed of lightning. Again the German came for him—this time head-on.

Bullets sprayed from both guns. Splinters flew from the wing struts. The prop on the German plane was injured. At the last instant the German plane dropped away, avoiding the crash. The Frenchman dove to attack the enemy once more. Again they approached head on.

MADON crouched low in his pit, using his engine for a shield with Spandau lead spraying all about him. And so did Madon's lead search for the revenge-maddened German. Neither altered their course. The ships roared toward one another with the combined speed of 250 m.p.h. It seemed like an eternity. Then they met.

Crash! Bang! A manmade clap of

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of "POPULAR AVIATION," published monthly at Chicago, Illinois, for April, 1932.
State of Illinois,
County of Cook,
ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared B. Geo. Davis, who, having been duly sworn according to law, deposes and says that he is the Editor of "POPULAR AVIATION," and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:
Publisher, Aeronautical Publications, Inc., 608 South Dearborn St.
Editor, B. Geo. Davis, 608 South Dearborn St.
Managing Editor, J. B. Rathbun, 608 South Dearborn St.
Business Manager, R. K. New, 608 South Dearborn St.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) W. B. ZIFF CO., 608 South Dearborn Street; W. B. ZIFF, 608 South Dearborn Street; DAVID ZIFF, 608 South Dearborn Street; B. GEO. DAVIS, 608 South Dearborn Street.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: NONE.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest, direct or indirect in the said stock, bonds, or other securities than as so stated by him.

B. G. DAVIS,
Editor.

Sworn to and subscribed before me this 1st day of April, 1932.
(SEAL) A. T. PULLEN.
(My commission expires January 25, 1936.)

thunder. The terrific tearing of linen, the brittle crunching of splintering wooden spars and struts, the shrill twanging of bracing wires snapping under the force of the impact.

With his feet braced on the rudder bar, and his back solidly against his seat, Madon held his course. It was to kill or be killed. The leather helmet of a German loomed ahead, just before the propeller cut him to mince meat. Madon veered off for the L. V. G. was going down—down with a headless pilot at the controls.

The Frenchman was now alert to the antics of his crippled plane. It dropped off dangerously on one wing. The shattered prop sent an alarming staggering tremor vibrating through his Nieuport. Madon cut his engine. He struggled to control his crippled plane to keep it in a glide. A cracked-up landing seemed inevitable. Great patches of wing covering lashed the breeze. The fuselage hung askew to the wings. His machine guns swung out crazily into space.

But Madon proved himself a great pilot. He brought his ship in to his own field. Set her down in a pancake and saved himself from what had seemed certain death. No wonder France gave him every medal available. Palms cluttered his Croix de Guerre in recognition of his bravery and 41 victories. He was one marvelous pilot—one tough fighter!

THE most difficult front, over which aerial warfare was carried on, was the Austrian-Italian frontier. Pilots stationed there had all the dangers of other sectors—and more. The Alps were a constant threat and handicap. High perilous fantastic snow-covered peaks interrupted the path of the birdmen. A single mishap, the misfortune of a moment and their task would be ended.

One of the most singular pilots to scan the lofty peaks was Major Francesco Baracca. He hopped the Alps to distribute tons of printed propaganda to stir the Austrians to revolt. He believed that paper—not bullets—would end the war.

His strange strategy was to soar aloft with his plane weighted down with pamphlets instead of bombs. He fought the enemy by flying far into Austrian territory and tossing his cargo overside. To him the death of a few individual pilots meant nothing. But to arouse the masses against their own country, as he aroused the Austrians—that was a truly important accomplishment.

Fundamentally, the technique that Baracca employed was propaganda bombardment. Yet he was one of the most efficient artillery spotters in the Italian Air Force. He had a knack of smelling out concealed Austrian batteries hidden high in the Alps. He regulated his own batteries' fire until they destroyed the Austrians.

With all his skill as a bomber with "paper bullets", he was forced to win victories in the air with lead. The Austrian Albatrosses were watchful for this long distance pilot. They lurked in the clouds hopeful of shooting him from ambush. Baracca made over 1,000 bombardment flights across the Alps.

Returning to Italy he was forced to fight every mile of the way. He surprised the enemy by the ease and speed he could maneuver his bombing plane. Using tactics employed by lighter pursuit jobs he shot down 36 enemy planes.

William Barker was one of the most brilliant pilots of the British Air Force to fly in Italy. Like Baracca he engaged in bombing raids. He mixed real bombs with his paper showers.

Strange that a man, forced into high altitude to hurtle the Alps, should later develop hedge-hopping tactics to such a high degree. After prolonged service in Italy, Barker returned to the Western Front. When an enemy pilot got on his tail, Barker would dive for the ground. The Germans, anxious for a kill and misled to believe Barker was having difficulties with his plane, invariably followed him down. The secret of Barker's success was that he knew Albatrosses as well as he did Camels.

The Camel was an extraordinary ship to maneuver at very low altitude. A clever pilot could maneuver it with ease into acrobatics that would be the doom of men in any other type of plane. Once Barker had a German down close to the ground, he literally hedge-hopped over the trees. He flew circles around the enemy and either shot him down, or forced him into a crack-up. That was strategy to the nth degree. He pulled five neat victories in one day.

ONE of our "scrappiest" fighters was Lieutenant Douglas Campbell. He sent the American Air Force into a tailspin of uncontrollable enthusiasm when he and Allen Winslow shot down the first victory for Squadron 94. Campbell became the first American trained ace. Tactics? That Californian lad didn't go in much for them. But he was a scrapper.

His determination to fight every hour he could be aloft, together with luck, went a long ways towards making Campbell one of our outstanding fighters. Luck and good old fashioned Western he-man gun play. Mix pluck with luck, add some fancy sharpshooting and you have a fighter.

Campbell practically taught himself to fly. He handled his Nieuport well. But he didn't go in much for *sorties* or *melees*—French for sparring matches in the air. Douglas believed if you want to fight a man and lick him, you wade into him, give him both fists, barrels, or what have you. He did!

He cared little about how he attacked. The fight was the thing. Campbell plunged in at any angle available. Fought like a demon. To throw the Germans off his tail, he relied upon the effective squirrel cage. Around and around in a series of loops. He made them all dizzy with this maneuver and his shooting.

His last battle clearly illustrates his variable methods of attack. Not much system. The thought paramount in the Californian's mind was to get in close and blaze away. He became the first ace in the 94th.

Then came May 30th—Decoration Day. A day of national mourning for America's valorious soldiers resting in eternal sleep. It was a special day of mourning for 94th Squadron—the day of Campbell's last fight.

A Rumpler two-seater was collecting valuable information. Campbell's Nieuport was banking in for a shot at the observer, veering off to escape a hail of deadly Spandaus lead. A murderous shot, this German observer-gunner. The pilot so skillfully manipulated his plane that his observer was always in a position to fire upon the American.

Campbell's Nieuport was like a determined mosquito. His engine roared a Hymn of Hate. He darted in, zoomed, dove, veered off. He attacked from behind, above, below—to either side. But the hail of Spandaus continued to pelter the swift little French plane. A perfect coordinating human machine this German pilot and gunner.

CAMPBELL wanted that Rumpler. He whirled and attacked from the front. Firing as he came, he poured a stream of lead down at it. The pencil line of white tracer smoke told him he was spraying the engine—then the cowling to one side of the pilot. The whirling prop of the German reconnaissance plane loomed ahead. Campbell zoomed over it.

The Boche observer redressed his Spandaus on the scarff mounting, and caught the Nieuport's belly in his sights. His twin machine guns flashed venomous flames. Hurled through space the most diabolical bullet used at the Front—the outlawed exploding bullet.

Straight it went for the Nieuport's fuselage. It tore through the machine, cut through Campbell's wooden seat, barely missing him.

As it pursued its upward course it exploded, cutting wires to bits. Fragments of wire, wooden struts and bullet flew in every direction directly behind Campbell. Some of the jagged fragments cut through his flying suit, buried themselves in his back.

Painfully wounded, Campbell whipped around, came tottering back at the Rumpler. His Vickers roared as he came. He went straight for the pilot's place. He never stopped firing. The big two-seater turned over as if bowled off its course by the vengeful force of Campbell's attack. It went down to crash, killing its two occupants.

That was Campbell's sixth and last victory. Luck had failed him, but his nerve hadn't. He recovered, but he never fought again.

END

XUM

Taxing Property

(*Continued from page* 358)

Knowing the scale of the map, and having studied the system sufficiently to know its peculiarities, it is possible for an engineer to plan any type of engineering project.

The tax assessor uses the air map consistently in checking the actual property as shown on the picture against his tax rolls. Thus, an official in one county recently discovered farm and ranch lands to the assessed valuation of $89,000 that was not on any tax roll! The property had never been systematically checked, the owners had not taken it upon themselves to render it, and accordingly it had gone along without officially existing.

END

Air Mail Monopoly

(*Continued from page* 352)

On August 22, 1931, Representative Kelly specifically charged Brown with refusing independents the right to bid on air-mail contracts over routes that they had pioneered and operated for months. Instead, Brown granted two "extensions" to the American Airways company, a subsidiary of the Aviation Corporation, although its ships never had flown over the routes in question.

ONE of these routes was from Memphis to New Orleans. The "extension" was granted to the American Airways on May 25, 1931. On July 1, 1931, the American Airways was also granted an "extension" on the route between Memphis and St. Louis. The Robertson Air Line had been carrying mail on both routes.

The extension was granted just after Robertson announced that he was on his way to Washington to offer a bid of 25 cents per flying mile over the 599 mile route. The American Airways was given the "extension" at the rate of 63 cents per mile. The government would have saved $18,000 per month, or $216,000 a year, if it had taken the low bid.

Later in the year Postmaster General Brown awarded the fat New York to Los Angeles contract to the Western Air Express, a subsidiary of the Transcontinental Air Transport, although it bid 97.5 per cent of the maximum rate allowed by law. The United Aviation company, an independent concern, which put in a bid for only 64 per cent of the maximum allowed by law, failed to get the contract. This contract is worth more than $2,000,000 a year and runs for four years. The government would have saved $2,680,000 during the life of the contract if it had accepted the lower bid.

POSTMASTER GENERAL BROWN threw out the low bid on the excuse that the low bidder could not conform to the specifications which called for air-mail pilots who had six months' experience as night flyers over a 250-mile route. These specifications were not inserted in the call for bids until barely two weeks before the bids were submitted—*and the schedule on that route called only for daylight service!*

The McNary-Watres act made absolutely no mention of night flying being required by air-mail carriers, but Postmaster General Brown discovered that the competing independent could not comply with this requirement and this gave him a plausible out in awarding the contract to the highest bidder.

Erle P. Halliburton, of the Southwest Air and Fast Express, Tulsa, was denied a contract, on which he was low bidder, on much the same excuse. Mr. Halliburton threatened to take the matter into the courts. This might have proved embarrassing, so Mr. Halliburton was mollified by being allowed to join with the Robertson Aircraft Transport, then a subsidiary of the Aviation Corporation, and they were awarded a contract for carrying mail from Atlanta to Los Angeles at 100 per cent of the maximum allowed by law!

The buying-off, or "absorption" of rival independent lines, whenever they become obstreperous and are about to resort to court action or threaten embarrassing investigations, seems to be a settled policy with the "Big Four" air-mail trust. Very recently, E. L. Cord, of the Century Air Lines and Century Pacific Lines, raised a disturbance because his concern had been turned down on several contracts, although it was low bidder.

Mr. Cord used his influence to get a hearing before the House Post Office committee, and at that time L. L. Young, his attorney, charged that the Cord lines could make a profit by carrying the air-mail at 50 per cent of the present rates. Had Mr. Cord personally repeated these allegations on the witness stand, they would have received widespread publicity, but just after the hearing got well under way, Mr. Cord suddenly left Washington and declined to press his charges.

There was no little mystification at that time among newspapermen over the sudden right-about face on the part of Mr. Cord. Three weeks later the mystery was solved when it was announced that the American Airways, Inc., operating subsidiary for the Aviation, Inc., has purchased the two Cord lines. No cash was involved, it was announced, but Mr. Cord was given 140,000 shares of stock in the Aviation Corporation.

This means the discontinuance of four main line air-routes and renders jobless some 350 employes of the Century lines. This recent deal amply confirms my charges that the mail subsidy—under the deliberate maladministration of governmental officials—is rapidly monopolizing air transportation into one gigantic trust.

Postmaster General Brown gave another of his notorious "extensions" to the Eastern Transport company, a subsidiary of the North American Aviation, Inc. It was awarded the contract to carry mail from Philadelphia to Atlantic City, although it had never flown a plane over this route.

The Ludington Line, on the other hand, had been operating a passenger service over this route for more than a year. Ludington offered to carry the mail for 25 cents per flying mile, but on July 1, 1931, Brown slipped the contract to the Eastern Air Transport without even asking for bids.

The same sort of indefensible discrimination is displayed in the disposition of foreign air mail contracts. The Mellon-owned Pan American Airways gets 96 per cent of the $7,000,000 subsidy and 3.2 per cent goes to the Aviation Corporation's American Airways.

Independents receive just 8/10 of one per cent of the Federal funds which were supposed to aid the aviation industry as a whole.

The Pan American is consistently awarded the contracts, although it never has been the low bidder. On June 15, 1931, the independents were bitter. The air mileage had been increased nearly 100 per cent and they wanted a chance to bid. Postmaster General Brown announced the route from Bangor, Maine, to Halifax, Nova Scotia, would be let by bids. On June 27, the Pan American was the only bidder at $2 per mile.

WHY was the Pan American the only bidder? Merely because the specifications called for the air-mail to be carried in 14-passenger ships, and the only four available for that route at that time were all owned by the Pan American. When newspapermen demanded of Assistant Postmaster Warren I. Glover why such an arbitrary requirement had been inserted, he admitted that W. P. McCracken, Jr., former aviation aid under Hoover in the Department of Commerce and now counsel for the Pan American, had helped him draft the specifications. Mr. Glover naively added that Mr. McCracken frequently helped his department prepare the calls for bids which concerned companies which Mr. McCracken represented as counsel.

Repeated scandals have marked the administration of the air-mail ever since the government ceased operating its own planes and turned this lucrative business over to private contractors. Back in 1928, when the rates were on a weight basis and ran as high as $3 per pound, some of the mail contractors actually were shipping bricks, scrap iron, old telephone directories and lead bars to themselves to swell their receipts. These dummy shipments would be made from Washington to New York, New York to Cleveland, and Cleveland to Pittsburgh, and the contractors would collect $7.75 a pound for all the junk they carried on this triangular trip.

The McNary-Watres bill put an end to these nefarious frauds by placing the air-mail contracts upon a weight-space basis and paying by the flying mile.

About 25 independent companies are

struggling along on passenger and express business without the aid of mail subsidies. They are facing a hopeless fight. It is admitted by everyone that the mail subsidies are the most profitable end of the business, and the privileged concerns which get these contracts can afford to cut passenger rates, which, of course, makes it easier to drive out the independents.

Most of the "Big Four" derive the bulk of their operating revenue from the air-mail contracts.

At the recent hearings on the Mead bill—which provides for the cancellation of all air-mail contracts that were awarded by "extensions" without advertising for bids—Postmaster General Brown boldly defended his actions and advocated a monopoly in the operation of air-mail service.

In the meantime, under the maladministration of the arbitrary power which Congress very unwisely placed in the hands of Mr. Brown, the independents will be unfairly put out of business by rivals financed with government funds. And, when the "Big Four" have the domestic air transportation field to themselves, they will effect new combinations, issue more watered stock and prepare to collect rates—with or without regulation—based upon these inflated values. The American taxpayer, of course, will foot the bill.

Instead of the air subsidies "stabilizing the industry", as it advocates promised, it has been used and still is being used to crush the smaller operators and is building up an enormous monopoly which menaces the whole future of American aviation.

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